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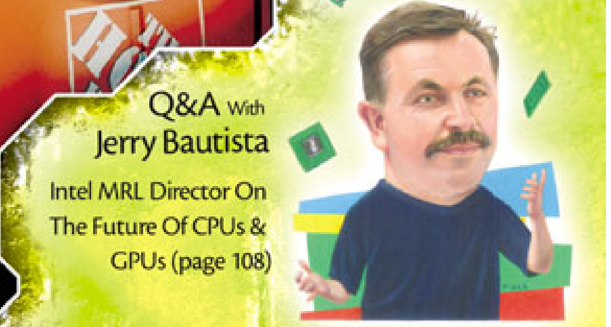

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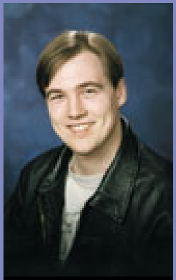
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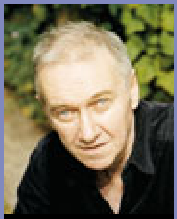
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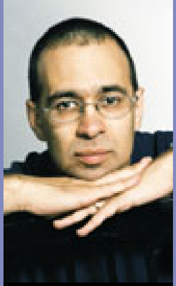
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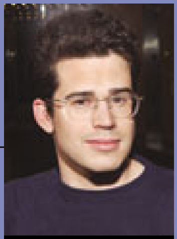
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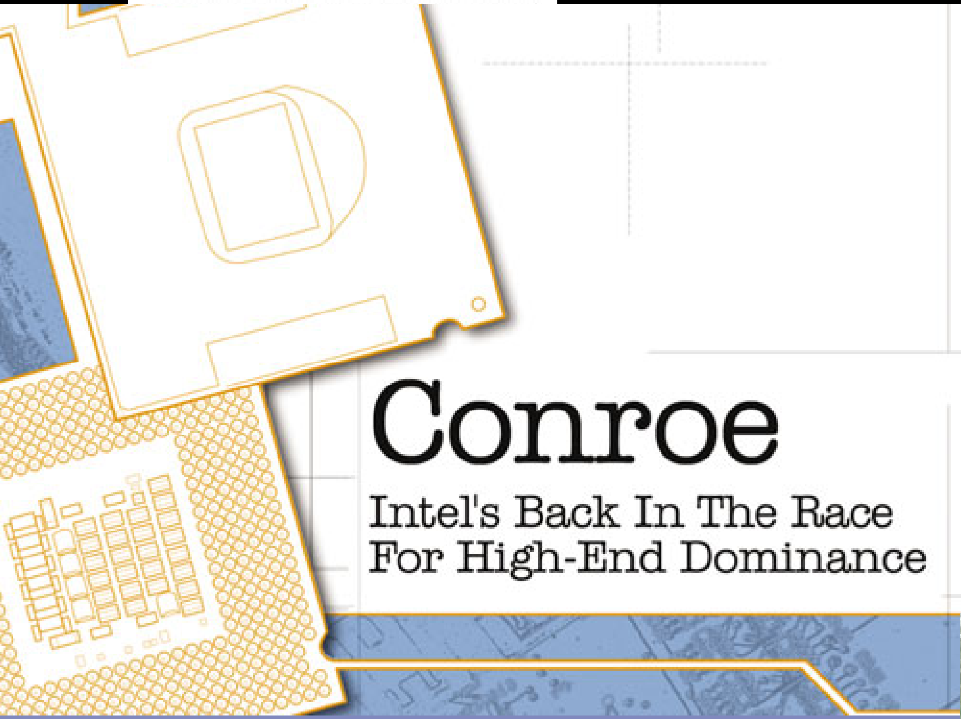

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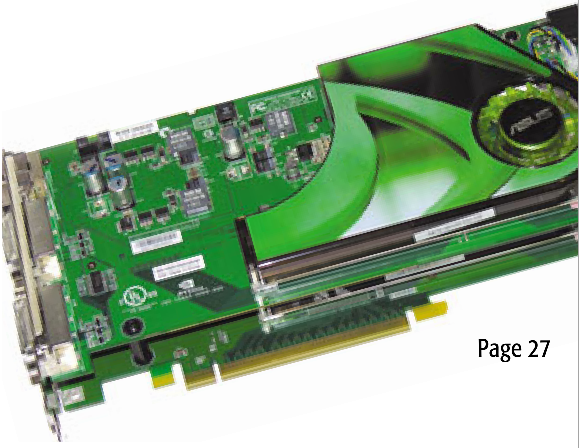

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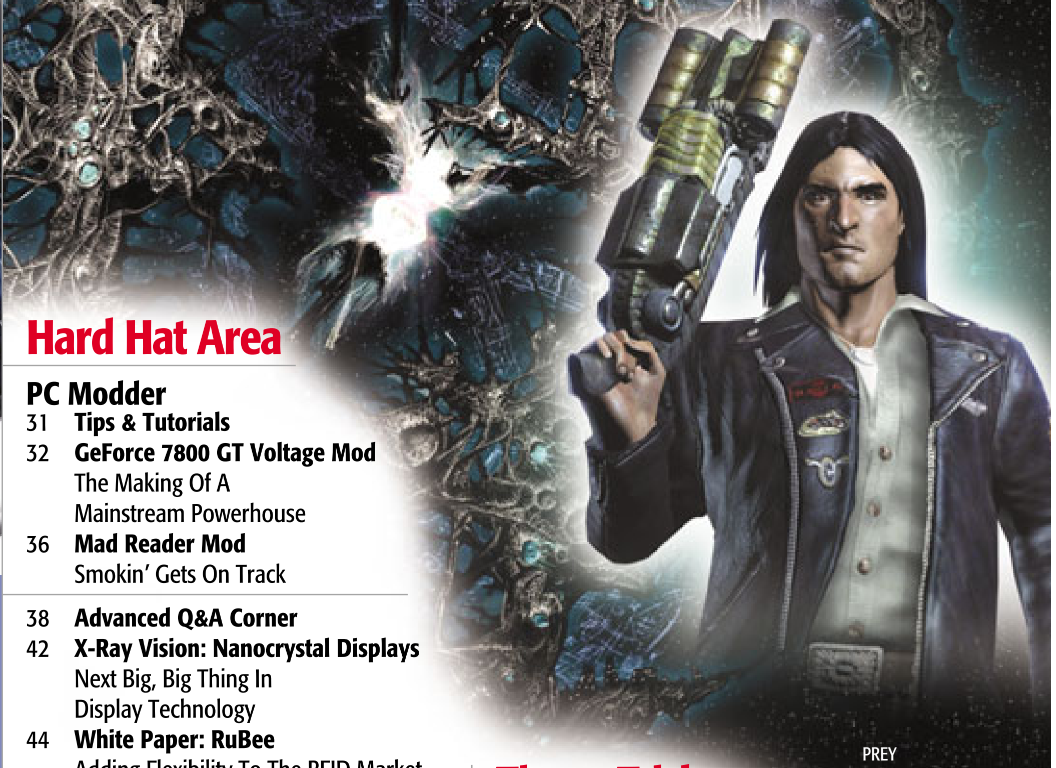

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CORRECTIONS:

On page 64 of the August issue, the second part of the DDR2 memory chart should be labeled "DDR2 At Various Clock Speeds & A CAS 5-5-5-2T Setting," and not ". . . CAS 6-6-6-2T Setting."

Infinite Loops

Strange stats and other oddball items from computing's periphery

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EDITOR'S NOTE

Last month we took an up-close look at AMD's new Socket AM2 platform, which is laying the groundwork for some very big things to come. Exciting stuff to be sure, but seeing as how AMD has been the performance leader in the high-end desktop market for several years now, we're not as blown away by great new AMD tech as we are by this month's spotlight subject: Intel's Conroe CPUs.

Officially dubbed the Core 2 family of processors, these chips represent more than just faster new CPUs; they are a tangible reassertion of Intel as a technological force to be reckoned with. People who have been following this industry for more than a couple of years remember when Intel was the de facto choice for high-performance procs; we've wondered for a long time just when the company would flex the muscle of its multi-billion-dollar R&D budget and do what it seems now to have done.

Intel's top dog, the Core 2 Extreme X6800, is a monster, but consider this line from Anand's column on page 28: ". . . the truly impressive part of Intel's Core 2 lineup isn't at the very high end, but rather the 2.4GHz E6600. The E6600 is faster than AMD's flagship Athlon 64 FX-62, and at just $316 costs less than 1/3 as much."

Wow.

Of course, we hardly expect AMD to step quietly aside and let Intel bask in the glow of this achievement; AMD will be back, and we can't wait to see what it has in store for us. For now, though, enjoy our Core 2 coverage in this month's Spotlight section, starting on page 48, and be sure to check out our usual lineup of columns, reviews, and interviews, as well. Have a great September; we'll see you next month.

Chris Trumble, Publication Editor, *CPU*

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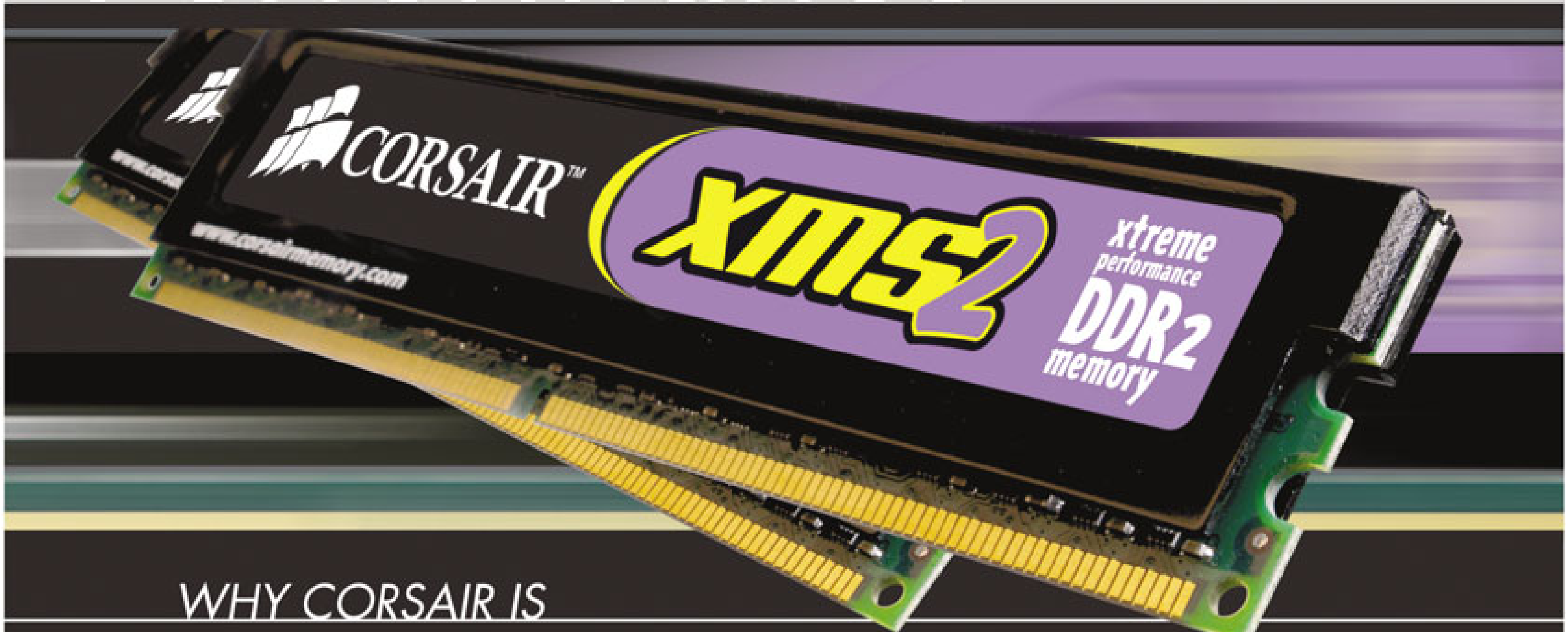

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What's Happening • Hardware

Compiled by Steve Smith

We'll be sorely disappointed if Sony's ultra-packed, ultra-mobile wunderkind doesn't show up somewhere in the next James Bond film.

Sony's Ultimate Micro

Ever laugh at a spec sheet? Sony's newly released VAIO UX180P ultra-mobile PC ($1,799) is redefining miniaturized excess. The 1.2-pound, 6-inch wide XP Pro PC runs a 1.2GHz Intel Core Solo CPU (533MHz FSB) with 512MB DDR2 memory and a 4,200rpm 30GB hard drive. There's a 4.5-inch SVGA LCD above and a pop-down 64-key QWERTY pad below. Not bad for a paperback-sized PC, huh? But that's only the beginning; the unit packs *two* 1.3MP digital cameras and has both 802.11a/b/g *and* Cingular WAN connectivity. Oh, and Bluetooth, too. And like any VAIO, the 180P is fully video and MP3 playback-capable and is bundled to the teeth with multimedia software. Half the laptops in our office are now shrinking in shame. ▲

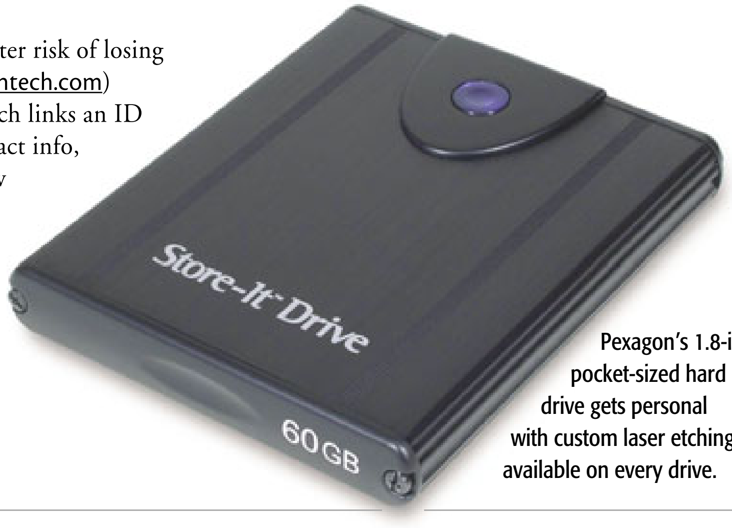
Wall Socket vs. Wi-Fi: 200Mbps & Counting

Before investing in that Pre-N Wi-Fi equipment, home networkers might consider just plugging their laptop network connectors into the wall socket. The new generation of powerline adapters push high-speed data via existing home electrical systems at a promised 200Mbps. Just plug one Netgear Powerline HD Ethernet Adapter ($129) into your router and wall socket to send a high-speed signal throughout your home grid. A second adapter plugs into any wall socket and sends the stream into any Ethernet device, whether a laptop, game console, or home media server. Netgear claims the latest iterations are 12 times faster than previous powerline techniques, and if they are any more reliable and consistent than some of the Pre-N Wi-Fi rigs we have been trying, then we're willing to have a go. ▲

With Netgear's new Powerline HD Ethernet Adapter your house is already wired to deliver streams of hi-def data at high speeds through a wall socket.

The Mini-Me Drive

We love miniaturized storage, but we don't love the greater risk of losing or misplacing such tiny devices. Pexagon's (www.pexagontech.com) answer is the myDrive LOST-N-FOUND program, which links an ID number engraved on the back of your drive to your contact info, which is stored in Pexagon's database for $9.99. The new Store-It puts 20GB ($149) or 60GB ($229) in a pocket-sized slab that weighs just a hair over 4 ounces. Our test unit was plug-and-play simple and didn't require drivers for the USB 2.0 connection. The Store-It's bundled software can automatically back up selected files with a simple press of the EZ-Touch Button Backup on every drive. We feel safer already. ▲



Pexagon's 1.8-inch, pocket-sized hard drive gets personal with custom laser etching available on every drive.

MP3s Finally Take To The Airwaves

The MusicGremlin ($299) is hungry and wants to eat the middleman out of the current digital distribution model—namely iTunes and your PC. The first Wi-Fi-enabled MP3 player is an 8GB device with built-in 802.11b capability and embedded software that connects directly to the MusicGremlin online music store. Not only can you browse and buy songs from the player itself, but sharing features let you peruse friends' playlists or send and receive songs from others. If you like, you can even order songs from the PC interface and have them download to the Gremlin the next time you boot it up. ▲

The first Wi-Fi-enabled MP3 player, the MusicGremlin, claims to connect directly to its own online music service for downloads.

Hardware Mole

A Mouse For Sweaty Gamers

With ultra-high resolutions and even customized weights in some models, what special features are left to add to gaming mice? Logitech's G3 Laser Mouse ($59.99) promises a DayGrip surface for improved fingertip control and less slippage due to sweaty gaming hands. And although we don't actually know exactly what polytetrafluoroethylene is, the G3 apparently uses the material for oversized bottom pads that make for a superior glide. We're guessing it stands up to all of the gamer hand sweat the company expects to drip all over the desk. ▲

Logitech's newest gaming mouse is shaped for "fingertip gripping" and smooth gliding.

Super-Cooled & Super-Fast

Think your custom rig is overclocked? Try 500GHz! Georgia Institute of Technology, working with IBM, cryogenically chilled a silicon-germanium chip to -451 degrees Fahrenheit in order to push it from a normal speed of 350GHz to 500GHz. Scientists said they were surprised by the good results and now need to find out if the super-cool temps altered the molecular structure of the chip at all. Yeah, we modders would like to know this because we're pretty sure our GeForce 6800 is not rated for a -451-degree F PC. ▲

Tough, Light, Sexy

When it comes to laptops, ruggedness often comes at a price, usually in the form of extra weight. Like most everything else in our "What's Happening" section this month, Panasonic is shrinking ruggedness down to an astonishing 2.8 pounds with its new eLite W4 Toughbooks. Starting at $2,199—we said light, not cheap—the W4 uses magnesium alloy to protect the screen and a flexible cabinet design that disperses pressure from movement and bending. And if you want to cringe a bit, visit the Panasonic.com site for video of researchers dropping Toughbooks in lab trials to test their durability. It's enough to make a geek faint. ▲

Compiled by DeanTakahashi

Cswitch Unveils A Configurable Communications Chip

Silicon Valley startup Cswitch has unveiled a Configurable Switch Array chip that's designed to bring the speed of a custom chip and the flexibility of a field-programmable gate array into one device. Founded by Doug Laird, the company has raised $44 million to create the new chip. This new chip is designed as an array of processors all interconnected together via a 2GHz bus for the purpose of processing Internet packets. The chip is also created for bandwidth up to 100Gbps and is fast enough to be coupled with network processors, handling the toughest functions in products such as network routers and switches. Manufacturers can program the chip with tools from Magma Design Automation. Laird says the company can configure the chip quickly, and it can perform as fast as custom chips that take as much as two years and $20 million to create. The chip gets as much as 10 times the performance per watt of an FPGA. ▲

Solar Demand Creates Shortage Of Silicon Wafers

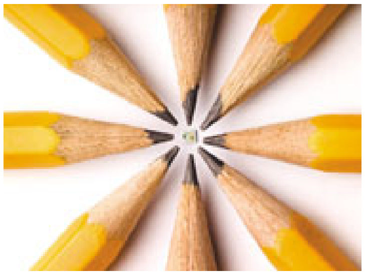
Polysilicon, a critical material both semiconductor chips and solar cells use, is in short supply these days. Demand has become so pronounced, says Jim Walker, an analyst at Gartner, that suppliers are scrambling to line up more product. A case in point is SunPower, which has agreed to pay $250 million to DC Chemical, one of Korea's largest chemical companies, to line up a supply of polysilicon over the next four years. Starting in 2008 DC Chemical will start production in a new factory that will be able to make 3,000 metric tons of polysilicon each year. DC Chemical will use money from SunPower to finance the new factory. This past May SunPower said it would spend more than $500 million over several years to M.Setek, which is building its first polysilicon factory in 2007. ▲

Watching The Chips Fall

Here is pricing information for AMD and Intel CPUs.

*Retail price
** Manufacturer's price per 1,000 units
Other current prices, if indicated, are lowest OEM prices available through Pricegrabber.com

CPU	Released	Original price	Last month's price	Current price
AMD Athlon 64 FX-60	1/10/2006	$999**	$901	$799
AMD Athlon 64 FX-62	5/23/2006	$1031**	$1031**	$1045*
AMD Athlon 64 X2 Dual-Core 4200+ energy efficient	5/16/2006	$417**	$417**	$417*
AMD Athlon 64 X2 Dual-Core 4200+	5/31/2005	$537**	$346	$355
AMD Athlon 64 X2 Dual-Core 4400+ energy efficient	5/16/2006	$514**	$514**	$514*
AMD Athlon 64 X2 Dual-Core 4400+	5/31/2005	$581**	$450	$442
AMD Athlon 64 X2 Dual-Core 4600+ energy efficient	5/16/2006	$601**	$601**	$601*
AMD Athlon 64 X2 Dual-Core 4600+	5/31/2005	$803**	$535	$539
AMD Athlon 64 X2 Dual-Core 4800+ energy efficient	5/16/2006	$671**	$671**	$671*
AMD Athlon 64 X2 Dual-Core 4800+	5/31/2005	$1001**	$620	$620
AMD Athlon 64 X2 Dual-Core 5000+	5/23/2006	$696**	$696**	$682*
Intel Pentium Processor Extreme Edition 965 3.73GHz dual-core	3/22/2006	$999**	$999**	$999**
Intel Pentium 4 640 3.2GHz 2MB cache 800MHz FSB 90nm	2/21/2005	$273**	$201*	$176
Intel Pentium 4 641 3.2GHz 2MB cache 800MHz FSB 65nm	12/27/2005	$218**	$207*	$207
Intel Pentium 4 650 3.4GHz 2MB cache 800MHz FSB 90nm	2/21/2005	$401**	$271*	$269
Intel Pentium 4 651 3.4GHz 2MB cache 800MHz FSB 65nm	12/27/2005	$273**	$269*	$249
Intel Pentium 4 660 3.6GHz 2MB cache 800MHz FSB 90nm	2/21/2005	$605**	$395	$329
Intel Pentium 4 661 3.6GHz 2MB cache 800MHz FSB 65nm	12/27/2005	$401**	$400*	$400
Intel Pentium 4 670 3.8GHz 2MB cache 800MHz FSB 90nm	5/26/2005	$849**	$610*	$615
Intel Pentium D 820 2.8GHz dual-core 2MB cache 800MHz FSB 90nm	5/26/2005	$241**	$171*	$164
Intel Pentium D 830 3GHz dual-core 2MB cache 800MHz FSB 90nm	5/26/2005	$316**	$214*	$189
Intel Pentium D 840 3.2GHz dual-core 2MB cache 800MHz FSB 90nm	5/26/2005	$530**	$335*	$373
Intel Pentium D 930 3GHz dual-core 2MB 800MHz FSB 65nm	12/27/2005	$316**	$176	$164
Intel Pentium D 950 3.4GHz dual-core 2MB 800MHz FSB 65nm	12/27/2005	$637**	$324	$317
Intel Pentium D 960 3.6GHz dual-core 2MB 800MHz FSB 65nm	5/1/2006	$530**	$530**	$541



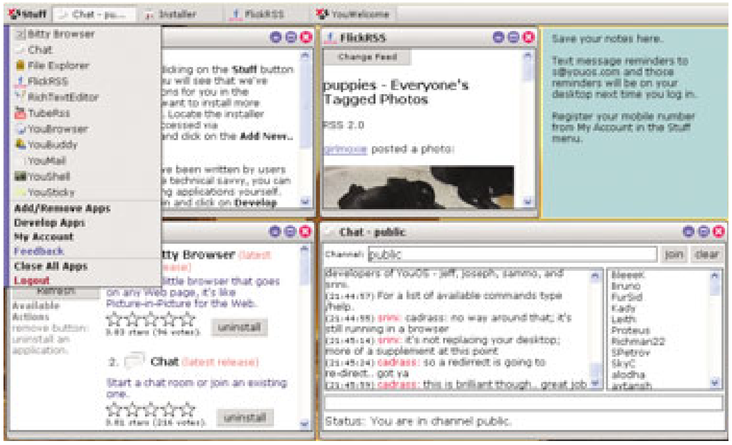
HP Makes Documents & Wristbands Trackable With A Wireless Chip

HP's researchers have developed a wireless data chip, dubbed Memory Spot, that sticks on any object for identification purposes. The chip bridges the physical and digital worlds, letting people tag documents or hospitals store medical records on a patient's wristband. The chip is about the size of a grain of rice (2 to 4mm^2), has a built-in antenna, and manufacturers can embed it within a sheet of paper. HP envisions users buying the chips in packages like buying a book of stamps; where users can peel the chips off the package and stick them anywhere. The chip transfers data at 10Mbps, or 10 times faster than Bluetooth, and has a storage capacity of 256Kb to 4Mb. These features make the new chip more functional than a typical RFID chip. The Memory Spot can access data via a read-write device that manufacturers can build into cell phones and handhelds. Among the applications that could use HP's new chip are audio photos, where the chip can add music, commentary, or ambient sound to accompany a photo; documents (the Memory Spot would contain the history of modifications to it); and other uses include enhancing security for identity cards or circumventing counterfeit tags on prescription drugs. ▲

Compiled by Trista Kunce

YouOS: Now That's Web 2.0

Still wondering whether Web 2.0 is just hype or the real hope for a next stage in Web development? Prepare to be dazzled by YouOS (www.youos.com), a "Web operating system" that literally stuffs applications, file storage, widgets, chat, and collaboration functions—a full OS-like experience—into a browser. This must-try project by four computer scientists from MIT, Caltech, and Stanford is sluggish in its 0.11 version, but it lets you log out of a session with multiple open windows and log right back in where you left off from any other PC. Rudimentary? Sure. But YouOS is a genuine glimpse into what virtual computing ultimately will be like. ▲



puppies - Everyone's Tagged Photos

RSS 2.0

grimoxe posted a photo:

Save your notes here.

Text message reminders to s@youos.com and those reminders will be on your desktop next time you log in.

Register your mobile number from My Account in the Stuff menu.

2. Chat (latest release)

Start a chat room or join an existing one.

developers of YouOS - jeff, joseph, sammo, and srini.
(21:44:57) For a list of available commands type /help.
(21:44:55) srini: cadrass: no way around that; it's still running in a browser
(21:45:14) srini: it's not replacing your desktop; more of a supplement at this point
(21:45:24) cadrass: so a redirect is going to re-direct.. got ya
(21:45:35) cadrass: this is brilliant though.. great job

Status: You are in channel public.

YouOS virtualizes the entire OS experience into a browser.

Search Different

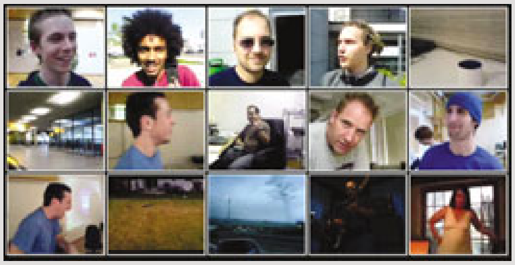
Sometimes we get bored searching the Web the same ol' way: Browse to Google or Yahoo!, type in a word, and find millions of links to Web sites that everyone else visits. This month we tried out two search engines with a little different take on searching the Web. PreFound.com is more of a "social" search engine that lets users see what other "humans have gathered by hand from all places on the Web." Searching for hotels in New York City, for instance, we got a list of user-recommended sites; not necessarily the most popular sites, or even sites relevant to our search, but helpful and interesting nonetheless. We also checked out Omnipelagos.com, which searches "for the shortest paths between any two things." The site is excellent for finding facts and odd connections between two things. We even found links between our favorite author and modding. ▲

PreFound.com
blog | how.it.works | sign.up! | PFfinder | help.others | link.to.us | help
search
advanced search

Site Seeing

Famous At 15 x 15

Admit it: You wouldn't mind being famous. We certainly wouldn't mind 15 seconds of fame, so we went to the 15x15 Web site (www.15x15.org) and uploaded a *CPU*-appropriate clip from our cell phone. The max file size for a video is 2MB, but you can post as many 15-second clips as you want—so maybe you can turn your 15 seconds of fame into 15 minutes. Good luck. ▲



Deep Thoughts On MMORPGs

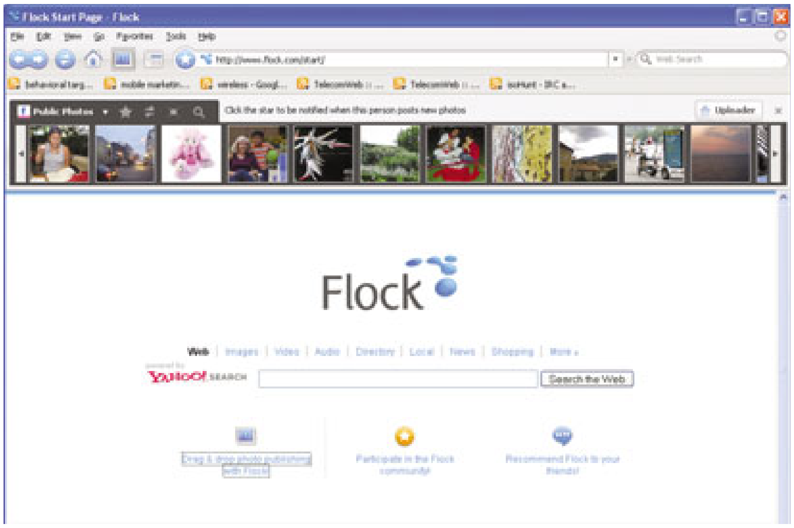
Male, female, old, or young, many of us enjoy online role-playing games. Nick Yee, on his Web site The Daedalus Project (www.nickyee.com/daedalus), analyzes the psychology and demographics behind playing MMORPGs. The number of men and women role playing was about equal in a recent Daedalus Project survey and most of these players tended to create their characters based on a "tragic" theme. Check out this site to analyze the character you role-play. ▲

Check Out TED For Free

Instead of paying $4,400 to attend a TED (Technology, Entertainment, Design) conference—that is, if TED even accepts your request for an invite—you can read all of the latest info in several areas, including technology, science, and entertainment from the latest annual TED conference on the TEDBlog (tedblog.typepad.com). You can also watch all of the TED Talks interviews with interviewees like Al Gore and David Pogue, via podcast. ▲

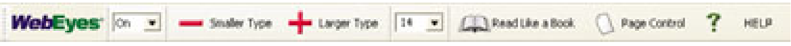
What's Happening • Software

Compiled by Steve Smith


Flock Start Page - Flock
Public Photos
Click the star to be notified when this person posts new photos
Uploader
Flock
Web | Images | Video | Audio | Directory | Local | News | Shopping | More »
YAHOO! SEARCH
Search the Web
Drag & drop photo publishing with Flock
Participate in the Flock community!
Recommend Flock to your friends!

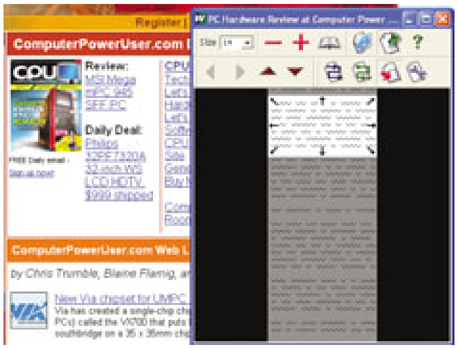
Join The Browser Flock

We've been talking about the collaborative Web browser Flock for months, and now we finally get a stable beta. Flock 0.7 (www.flock.com) is all about sharing content and making the browser interact with online user-generated material such as images and blogs. You can share your favorites, although that feature was still a bit confusing in this iteration, and share photos via Flickr or Photobucket. A toolbar outwardly displays Flickr images and literally lets you drag and drop images into the collection. You can also right-click most Web pages and publish them directly as links on your existing blog. Although still a bit sluggish when we used it, Flock is already showing signs that it may fly high among the digerati. ▲



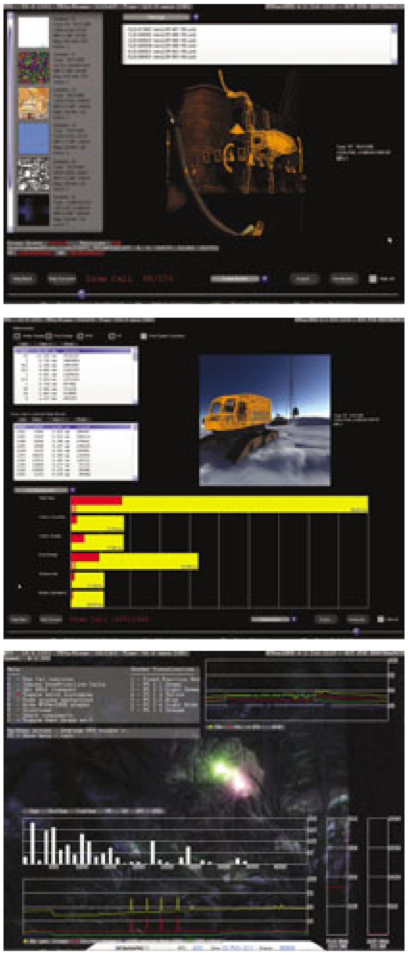
WebEyes Battles Scroll & Squint

The usual cure for microscopic text on Web pages is holding the CTRL key and rolling your mouse wheel up, but Avanquest's (www.avanquest.com) unique WebEyes ($19.95) software is a more elegant, versatile answer. This toolbar for Internet Explorer not only adjusts fonts to specific sizes on-screen but even "reflows" the Web page into a book format. You can turn a long page scroll into multiple columns that you page through in a pop-up window, complete with images and clickable links. We're waiting for Avanquest to add printing options to this cool tool, but we still think this is a sight for sore eyes. ▲


ComputerPowerUser.com
Register
PC Hardware Review at Computer Power
Review:
MSI Mega mPC 945 SFF PC
Daily Deal:
Philips 32PF7320A 32-inch WS LCD HDTV $999 shipped
ComputerPowerUser.com Web

Squeeze More GeForce From Nvidia Cards

Nvidia says it can help game developers wring even more performance from its GPUs with the new NVPerfHUD 4 performance analysis tool. The display runs via Direct3D apps under DirectX 9.0c to find rendering bugs and improve performance on average 35%. The HUD draws information from the game, resident drivers, and the API. It can analyze and graph how scenes tax the GPU and cause bottlenecks. It can even freeze the current frame and drill into minute details about how they call on the hardware. Almost sounds like a Sim game itself. ▲



Game developers get a new HUD display for finding bugs and tweaking performance on games running Nvidia's GPUs.

Software Shorts

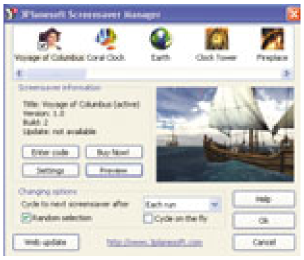
GreenBorder's Fearless Surfing

As the identity thieves get smarter, security countermeasures are getting even more imaginative. GreenBorder Pro's (www.greenborder.com; $49.95 per year) novel approach copies your PC's setup and system state into a virtual computing space. Any unknown program runs within this protected zone so it never touches a real system file or changes the PC's state. A "privacy zone" automatically clears any record of personal data you enter into a Web site, so that it never sits within a browser cookie. By letting new programs and Web interactions run in a virtual space, GreenBorder says it maintains security without the traditional signature codes or virus profiles. Is it safe? Try it out for yourself: The first 10,000 customers who download the new program before Sept. 1 will get a free, one-year license. ▲

GreenBorder Pro says it protects your PC by running potentially dangerous programs in a protected zone where they never have access to your OS' permanent files and state.

Sail The Virtual Ocean Blue

As true Columbus Day celebrants, we're getting into the spirit of Columbus Day (Oct. 12) early and "sailing" to 3planesoft.com for the Voyage Of Columbus 3D Screensaver. Why pay $12.95 for a screen saver in this post-1492 age? Because you'll get to experience a full 3D rendition of a day in the voyage of Columbus' three ships complete with accurate 3D digital models of the boats, on-deck crew, and roiling seas. You can adjust the speed of the screen saver from real to 120 times real, watch the sun rise and set on your voyage, and even run an FPS counter to gauge performance. We bet Columbus never thought about putting an FPS counter on the bow of the Santa Maria. ▲



Spend a day discovering new worlds with Christopher Columbus and his crew in a stunning new screen saver.

VoIP TV?

The Japanese firm Novac claims its new combination of TV tuner hardware and software runs home TV signals to any PC anywhere using the Skype P2P VoIP network. The software exploits the Internet phone service's videoconferencing feature to send out the A/V signal. The instant messaging channel sends back channel changing commands. But we would like to hear from Novac when it adds in TiVo control and playback. ▲

A Japanese company is hawking a gadget plus software package that runs TV signals across the Skype network.

BIOS Upgrades Available Online

Compiled by Steve Smith

Before you send another motherboard to the landfill, consider upgrading the BIOS and giving your PC a new lease on life. Here are a few recently released upgrades. Readers can check out www.cpumag.com/cpusept06/bios to see our entire upgrade list.

Motherboard	Date Available	URL
Abit Aw8	5/22/2006	www.abit-usa.com/images/download_button.gif
AOpen i975Xa-YDG	6/10/2006	download.aopen.com.tw/userdownload_List.aspx?RecNo=10907&Model=i975Xa-YDG
ECS KA3 MVP	7/07/2006	www.ecs.com.tw/ECSWeb/Downloads/ProductsDetail_Download.aspx?CategoryID=1&Typeid=35&detailid=659&DetailName=Bios&DetailDesc=KA3%20MVP&MenuID=35&LanID=9
MSI K8NGM2-IL/K8NGM2-L	6/16/2006	download.msi.com.tw/support/bos_exe/mbd_bios/7207v15.zip
Tyan Tempest i5000VF	6/12/2006	ftp://ftp.tyan.com/bios/5370_101.zip

The Job Search

Think Google's new video search libraries are cool? How would you like to run one of its "acquisition centers," which encodes and processes clips for the engine? Google collects links to video from around the Web and partners with major brands such as CBS, PBS, and several record labels to compete with Yahoo!, YouTube, and iTunes over bragging rights to the Web's best clip library. As Video Operations Manager, you could run a team of fellow Googlies dedicated to processing some of the coolest clips, TV shows, music videos, and weird films—there are a lot of those here—into searchable media in multiple downloadable formats. This is a job for a good engineer with managerial skills and five years experience in logistic and operations. In other words, you need to know less about re-encoding video yourself and more about how to get others to do it efficiently. Better still, you may be the first to see the latest Paris Hilton music video—and that would be a shame to miss, now wouldn't it?

50%
Google's share of all online searches
Nielsen//NetRatings

5 MILLION
Number of visitors on opening day to Yahoo!'s FIFA World Cup site
comScore

$13 billion
Predicted size of online gaming market by 2011
DFC Intelligence

More Video Than We Can Watch

For all the talk about media fragmenting into a host of different time- and place-shifting devices, it turns out that most Americans are pretty ambivalent about accessing digital content in new ways. Whether it involves a video podcast of a TV show, renting a movie via an Internet download, or even buying a film online to burn to your own DVD, only about 10% of us expect to be engaging these new distribution methods in the next year. "It's pretty clear to us that most consumers lean toward the path of least resistance—involving the smallest amount of learning and behavior change," says Ipsos SVP Todd Board.

Future Video Worth Watching*

13%
Access free TV show via podcast with embedded ads

11%
Buy $1.99 TV program online for iPod or to burn on DVD (up to three times)

10%
Buy $9.99 movie online for iPod or to burn on DVD (up to three times)

9%
Rent a time-limited movie online ($4.99) for playback on portable or Internet-connected device

9%
Rent a time-limited, 99-cent TV program or sports event for playback on portable or Internet-connected device

*Percentage of U.S. adults who would seriously consider each entertainment activity a year from now.

Source: Ipsos

The Saint

Changing Times

by Alex St. John

I have witnessed many major transitions in the game industry in my career. I was at Microsoft when 3D hardware acceleration became a consumer commodity that enabled Sony to appear out of nowhere as a dominant game platform. The 3D phenomenon also allowed Microsoft to make Windows the dominant PC gaming platform by enabling companies like ATI and Nvidia to compete for dominance in PC graphics acceleration under a common 3D API provided by DirectX. Over the years 3D went from being a neat feature in some types of games to the dominant gaming environment. The makers of 3D authoring tools like Maya and 3DStudioMax, which had originally been designed for CAD applications and moviemaking, discovered their primary market had become game developers. Most interestingly, free-market competition over 3D acceleration in the PC market produced such rapid innovation that it became nearly impossible for traditional console companies to make proprietary 3D chips that were competitive with those made by North American companies such as ATI and Nvidia.

Now another major transition in gaming is taking place, one which will topple old giants and create new ones. This new transition is more disruptive and more sweeping than something as simple as an advance in game graphics from 2D to 3D. It is driven by powerful economic forces that accelerate rapidly as more and more gamers and game consoles are connected to a network. The two major drivers of this transition are of course the growth in connected gamers and the soaring cost of producing modern games.

We live in a situation in which everything about gaming has to change in order for anybody to be in the game business.

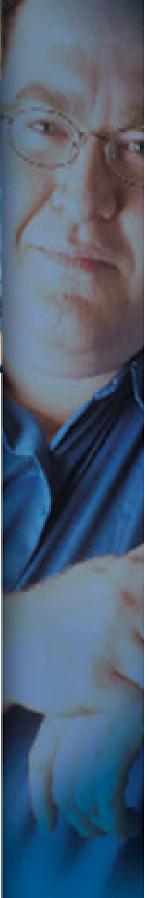
In previous columns I've blamed Microsoft and Intel and their persistent lack of vision for the decline in the PC gaming business, but there is one other major culprit: World of Warcraft. The game has single-handedly sucked all the oxygen out of PC gaming's atmosphere. Any game not as grand in scope, as addictive, as efficient at generating long-term revenues from players, or as community-centric simply can't compete. Generating a purported billion dollars a year in revenues from an audience of 6 million players who barely have time to eat and sleep between game sessions, WoW is the monster that is eating the game industry. (My family has four WoW accounts; we have canceled our cable TV.)

The new game industry will look very different from the old. The old game industry produced monolithic titles whose principal business model was to sell a cardboard box in retail. The new game industry will feature titles with content that is principally community-generated, may be fully or partially distributed online, is supported by advertising, and evolves more like an epic television series than a major motion picture. Games will still derive revenue from traditional boxed sales, but will also increasingly rely on revenue from advertising, subscription fees, and in-game item purchases. Games will be inherently community-based rather than content-based as they are today. In other words, the fun will increasingly emerge from interacting with other participants in the game rather than consuming pre-authored content.

Game developers and publishers are being forced to make a difficult choice: They must leave the comfort zones of traditional game development to either create epic games like WoW or to try their hand at making small, community-centric short-form games intended for electronic distribution.

The industry's growing pains are evident as its members struggle to invent these new genres and business models. Upstarts such as Jagex in the UK are enjoying amazing success with games like RuneScape, a Java-based, 3D MMOG that is largely free, is supported by advertising and marketed by word of mouth, has solely online distribution, and that has acquired an audience of nearly 9 million players virtually overnight. Meanwhile, mighty media companies launch services like GameTap with great fanfare and expense that crater catastrophically in short order. This generation of console wars will not be about whose console has the most ridiculous, obsolete graphics capabilities that no game can use. It will be about which console supports next-generation games the best. ▲

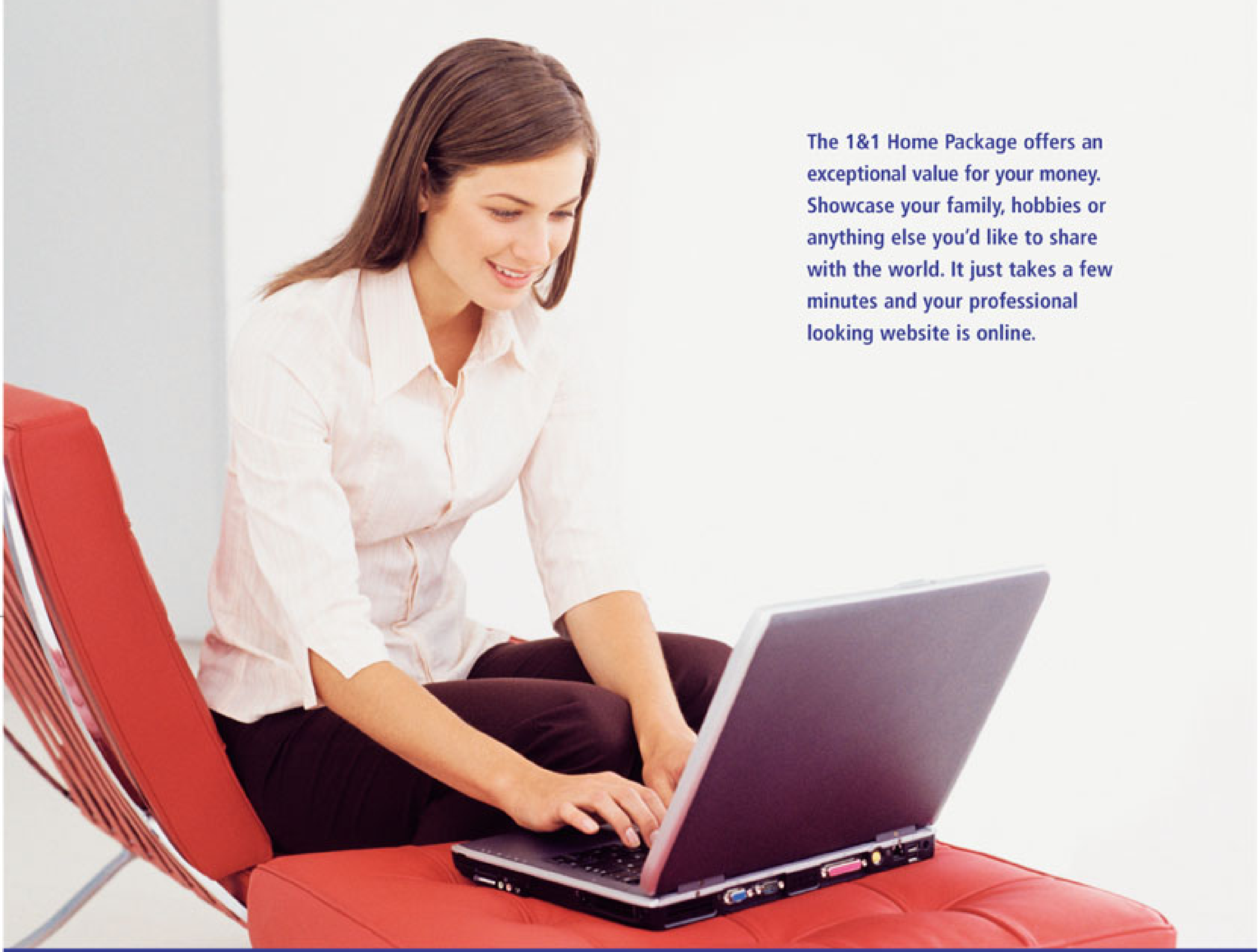
Alex St. John was one of the founding creators of Microsoft's DirectX technology. He is the subject of the book "Renegades Of The Empire" about the creation of DirectX and Chromeffects, an early effort by Microsoft to create a multimedia browser. Today Alex is President and CEO of WildTangent Inc., a technology company devoted to delivering CD-ROM quality entertainment content over the Web.



We live in a situation in which everything about gaming has to change in order for anybody to be in the game business.

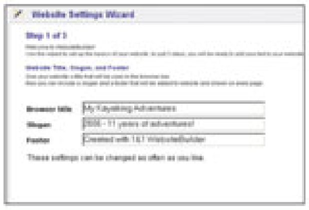
Send your feedback to TheSaint@cpumag.com

1&1 Web Hosting, Simply



The 1&1 Home Package offers an exceptional value for your money. Showcase your family, hobbies or anything else you'd like to share with the world. It just takes a few minutes and your professional looking website is online.

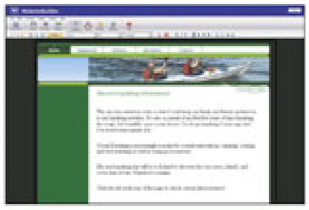
Create your website in 4 easy steps. It's that simple.



1 Personalize your website

2 Choose your layout

3 Add pages



4 Add text and publish

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with all 1&1 Shared Hosting Packages
Limited Time Offer!

Compare for yourself!

	1&1	YAHOO!	Go Daddy
	HOME	**STARTER**	**DELUXE**
Included Domains	2	1	$1.99/year with purchase
Web Space	50 GB	5 GB	50 GB
Monthly Transfer Volume	500 GB	200 GB	500 GB
E-mail Accounts	1,000 IMAP or POP3	200 POP3	1,000 POP3
Mailbox Size	2 GB	2 GB	10 MB
RSS Feed Creator	✓	–	–
Blog	✓	✓	$2.99/mo. for ad-free blogs
Search Engine Submission	✓	✓	$29.99/year for submission and optimization
Search Engine Optimization	90-Day Trial	90-Day Trial	
Geographic Map	✓	✓	–
Website Builder	12 Pages	✓	Freeware
Flash Site Builder	12 Pages	–	–
Photo Gallery	✓	✓	✓
Dynamic Web Content	✓	✓	–
Chat Channels	✓	–	✓
Starter Software Suite	✓	–	–
90-Day Money Back Guarantee	✓	–	–
Support	24/7 Toll-free Phone, E-mail	24/7 Toll-free Phone, E-mail	24/7 Phone, E-mail
Price Per Month	$4.99	$11.95	$6.99
SPECIAL OFFER	**25% off for 1 year!**	**25% off for 2 months**	–
TOTAL/YEAR	**$44.91**	**$137.42**	**$83.88**

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DREAM HARDWARE

These Gizmos Don't Sing It, They Bring It

The date was going pretty well, by your standards. She understood right away why your new video camera was so geeky-cool. And she fell in love with your quick-change four-wheeler. Unfortunately, when you took a turn into the ocean for a moonlight jet ski ride, her sexy shoes nearly electrocuted you both.

by Marty Sems

Electric Cinderella Shoes

"She's a femme fatale . . . see the way she walks." Nico's and Lou Reed's voices pop into our heads whenever we ogle these heels. They pack a kick. Combining feminine empowerment, fashion, and a stun gun, the Electric Cinderella shoes can put the spark to a would-be attacker. A solid kick breaks the toe of one of the shoes, delivering 100,000 volts from a single-use 9V battery stored in the heel. The wearer can enable the electrodes with a special earring. Inventor Simona Brusa Pasque says she's still looking for a partner to build and sell the ferocious footwear, which she pitches in an intriguing way at www.gattamatta.com.

Silicon Imaging SI-1920HDVR Digital Cinema Camera

Utterly amazing. How else to describe the first fully digital, direct-to-hard drive HD camera that records in 10-bit Cineform RAW format (www.siliconimaging.com)? The SI-1920HDVR uses a dual-core processor and a Seagate PMR hard drive to capture stunning 1,080p video at 96Mbps. Silicon Imaging claims the cam's big 16:9, 2/3-inch CMOS has a depth of field near that of 35mm. $21,000 will get you a full kit with all options, including the camera head, storage, mount, lens, and a Prospect HD and Adobe Premiere Pro 2.0 editing suite. Look for shipping units in Q3. At this writing the only existing models are currently on location in South Africa with a bleeding-edge production team. Their shoot is worth a look at indiefilmlive.blogspot.com.

Gibbs Quadski

How very Bondian. Amphibially minded Gibbs (www.aquada.co.uk), the firm that brought us the car/boat, Aquada, and the Hummer/boat, Humdinga, has bred a jet ski with a four-wheeler. The new 140bhp baby is kind of peppy, as you can see from the photos. Hop on and tear up the beach at 50mph. Impress pretty girls. Kick sand in the faces of the muscle-bound and foot-bound. Should said weightlifting types become angry and locate a dune buggy, simply laugh and flick a switch. "Ha, ha!" you'll cry, as five seconds later you take to the ocean, leaving your incensed foes behind, tearing their goatees and gnashing their grillz. Gibbs can't discuss the Quadski's pricing or availability yet, but "they're currently in talks about it," says spokesman Sam Leifer. ▲

A Cool, Dry Place

We Put Six Waterless Chip Coolers To The Test

Whenever Intel or AMD launch a new platform, early adopters, aka power users such as yourselves, typically flock to the new hardware and immediately begin to tweak, overclock, and otherwise push it to the limit.

With both Intel and AMD launching new platforms within a couple of months of each other though, we thought we would eliminate some of the guesswork for you and find out just how far we could push each company's respective flagship processors using a broad spectrum of readily available CPU coolers. I lined up six coolers in total, three for each platform, with prices ranging from $24 to almost $70. Which coolers did I like best? Read on and find out.

AMD-Based Coolers

AMD's Athlon 64 family of processors' high-performance and relatively modest power requirements mean it's easier to keep Athlon 64-based systems cool—even while overclocked—with a basic heatsink and fan combination. Many enthusiasts even stick with AMD's stock PIB (processor-in-a-box) cooler because a higher-performing model isn't a necessity.

Of course, though, it couldn't hurt to keep today's higher-clocked, DDR2-equipped dual-core Athlon 64 X2 and FX processors running cooler than the stock heatsink and fan combo can. So I pulled together a trio of AM2 compatible coolers and ran them through a series of tests with an overclocked Athlon 64 FX-62 powering my rig.

5F521B1M3CG
$23
Masscool
www.masscool.com
●●●

Specs: Construction: copper; Air Flow: 34.46cfm; Fan Connector: 3-pin; Fan Size: 80mm; Heatpipes: none

Masscool 5F521B1M3CG

The Masscool 5F521B1M3CG is the most traditional cooler in this roundup, but it's anything but stock. This cooler's specifications claim compatibility with all Socket 940, 939, and 754 Athlon processors. Its single-clip design, however, means it will fit virtually all Socket AM2 motherboards, as well. To be sure, I installed the 5F521B1M3CG on a handful of Abit, MSI, Asus, and ECS AM2 motherboards and didn't have any issues whatsoever. The cooler's secondary plastic-locking mechanism wouldn't have anything to latch on to if I installed it on an AM2 socket, but this wasn't an issue throughout testing. If you plan to move your systems regularly, though, make sure the locking clip doesn't disengage during transport.

As I have already mentioned, the 5F521B1M3CG is a somewhat traditional cooler that doesn't have any exotic looking heatpipes or radical new designs. Its entire heatsink is made of copper with a steel shroud and an 80mm ball bearing fan. Masscool doesn't include any form of fan control, but at its maximum speed, the fan is relatively quiet at <30dBA. Out of the box Masscool machined the cooler's flat base to a near mirror finish. Machining marks were visible on the base, but the grooves were smooth to the touch and shouldn't pose any problems. Lapping the base would likely improve the 5F521B1M3CG's performance, however.

Installing the Masscool 5F521B1M3CG couldn't have been any easier. The cooler

AMD Socket AM2 Platform Cooling Performance: Stock & Overclocked

I tested the Masscool 5F521B1M3CG, Thermaltake Mini Typhoon, and Zalman CNPS9500 AM2 coolers on an Asus M2N32-SLI Deluxe motherboard powered by AMD's Athlon 64 FX-62 dual-core processor.

During the tests, I used Asus' PC Probe II application to monitor temperatures. To tax the processor during my load tests, I used a combination of Folding@Home and the multithreaded SiSoftware Sandra processor burn-in tests. I ran the Stock Idle and Stock Load tests with the processor clocked at its default frequency of 2.8GHz. But I ran the Overclocked Idle and Overclocked Load tests with the FX-62 clocked at 3.1GHz with a 1.55V core voltage. I recorded peak temperatures after approximately 30 minutes of idle or load time and ran each cooler's fan at its maximum speed where applicable.

My results put the CNPS9500 AM2 cooler at the head of the pack, but the Mini Typhoon finished right behind the Zalman offering. The inexpensive 5F521B1M3CG also performed relatively well considering it doesn't have any heatpipes and the other coolers I tested dwarfed it. (*NOTE: The temperatures in this chart are indicative of how the Asus M2N32-SLI Deluxe's BIOS interprets the data being read from my Athlon 64 FX-62's internal thermal diode. Testing the same processor and coolers on a different motherboard could yield different results.*)

	*Stock Idle FX-62 at 2.8GHz	*Stock Load FX-62 at 2.8GHz	*Overclocked Idle FX-62 at 3.1GHz	*Overclocked Load FX-62 at 3.1GHz	Noise Level
Masscool 5F521B1M3CG	39	50	46	56	26.5dBA
Thermaltake Mini-Typhoon	37	47	43	52	18dB
Zalman CNPS9500 AM2	35	47	43	50	18.0 to 27.5dBA

*In degrees Celsius

features a single, steel retention clip. Lock one side onto the Socket AM2 bracket, push the other side down with your thumb to lock it into place, and then engage the secondary locking mechanism to secure the cooler in place. You'll need a flathead screwdriver to disengage the steel retention clip to remove the cooler, though.

Thermaltake Mini Typhoon CL-P0268

We were impressed by Thermaltake's Big Typhoon last year and recommended it in our "Ultimate PC Hardware Holiday Gift Guide" in the November 2005 issue of *CPU* (page 54). This year Thermaltake's revamped the Big Typhoon's design by making it smaller and better in a number of ways.

The Thermaltake Mini Typhoon CL-P0268 is technically a universal cooler, in that it's compatible with both AMD and Intel platforms, but I lumped it in with the AM2 crowd because the Mini Typhoon doesn't fit on every LGA775 motherboard. The cooler shipped with a pair of steel retention clips that line up with guides on the mounting plate. When installing the Mini Typhoon on

Mini Typhoon CL-P0268
$49
Thermaltake
www.thermaltake.com
●●●◖

Specs: Construction: copper; Air Flow: 38.7cfm; Fan Connector: 3-pin; Fan Size: 92mm; Heatpipes: 6

CPU RANKING ○ 0 = ABSOLUTELY WORTHLESS | ●●◖ 2.5 = ABSOLUTELY AVERAGE | ●●●●● 5 = ABSOLUTELY PERFECT

> The Mini Typhoon's waved copper fins, six heatpipes, and quiet fan made it one of the quieter and better-performing coolers in this roundup.

an AM2 board, the heatsink's base runs parallel to the socket's mounting clips, and all you need to mount the cooler is a bit of force to lock the retention clip and its secondary locking mechanism into place. On the LGA775 platform, though, the heatsink lies over the socket diagonally, and the cooler's oversized base plate can interfere with the capacitors surrounding the socket. I had no trouble using the Mini Typhoon on any AM2 board, and it worked fine on Intel's DX975XBX, but it wouldn't fit on an Asus P5B Deluxe.

The Mini Typhoon's waved copper fins, six heatpipes, and quiet fan made it one of the quieter and better-performing coolers in this roundup. This unit is easily one of the better coolers for the socket AM2 platform, especially considering it's available for almost $20 less than Zalman's entrant. Intel users should approach the Mini Typhoon with caution, however.

Zalman CNPS9500 AM2

AMD's new platform may be only a few months old, but one cooler in particular has already established itself as the granddaddy of all socket AM2 coolers: Zalman's CNPS9500 AM2. The CNPS9500 AM2 has everything I look for in an air cooler: It is quiet, easy to install, has a unique aesthetic, and it is a great performer. I am not the only one who the Zalman CNPS9500 AM2 pleases; Nvidia recommends users use this cooler on motherboards based on its nForce 500 family of chipsets.

The CNPS9500 AM2 is constructed almost entirely of nickel-plated copper. Zalman polishes the heatsink's base to a perfect mirror finish, and three figure eight-shaped heatpipes run from the base, through the heatsink's fins, and back to the plate. Zalman claims that this loop-back design lets the configuration of the three heatpipes perform much like a cooling unit with six heatpipes. My tests seemed to back up this claim, as the CNPS9500 AM2 outperformed the six heatpipe Mini Typhoon by a couple of degrees in a few tests.

Similar to the other two coolers mentioned before, installing the CNPS9500 AM2 required nothing more than fastening a retention clip in place. The CNPS9500 AM2 shipped with thermal paste, a case badge, and an adjustable fan controller, and the cooler's fan glows a deep green. From a design and performance standpoint, there is a lot to like about the CNPS9500 AM2. It's nearly $70 price tag, however, may put off some users.

Intel-Based Coolers

Over the past few years, Intel's Pentium 4 and Pentium D family of processors have earned a notorious reputation for running excessively hot and consuming an exorbitant amount of power. Intel improved the Pentium D's thermal and power characteristics considerably after the transition to the company's 65nm process node and the incorporation of C1E halt state functionality, but after years of contending with the heat Intel's processors produced, heatsink manufacturers had to come up with some interesting designs to keep temperatures within tolerable limits.

Luckily, any heatsink a manufacturer designs for Intel's socket LGA775 (Socket T) platform will also work with the new Core 2 family of processors.

CNPS9500 AM2
$64
Zalman
www.zalmanusa.com
●●●●

Specs: Construction: Nickel-plated copper; Fan Speed: 1,350 to 2,600rpm; Fan Connector: 3-pin; Fan Size: 92mm; Heatpipes: 3

And because Intel's new desktop CPUs now consume much less power than their NetBurst-based cousins, high-end heatsinks for the Pentium D are a perfect match for the Core 2 Duo. I got my hands on a trio of LGA775 compatible coolers, priced as low as $24 and as high $59, and took them to task with Intel's current flagship CPU, the Core 2 Extreme X6800.

Scythe Katana 775

The Scythe Katana 775 surprised me on a couple of different levels. When the unit first arrived in the lab, I opened the box only to find a couple of the push pins used to mount it were bent during shipping. I easily straightened the pins with a pair of needle-nosed pliers, but opening a box and finding a damaged product is never a good way to start things. The next thing I noticed was how lightweight the Katana was. This cooler's mix of a copper base and dual heatpipes with thin, aluminum fins made it feel somewhat insubstantial in my hands.

After I installed the Katana 775 onto my test bed and put the cooler through the wringer, my initial trepidation was gone. The Katana 775 proved to be a decent performer and had no trouble keeping my Core 2 Duo Extreme X6800 CPU up and running at a speedy 3.55GHz. The cooling unit also features a 4-pin fan similar to Intel's stock cooler, so its speed was throttled based on the CPU's core temperature. In all but the most taxing situations, the Katana 775's fan remained quiet, and even when it did spin up, the slight whir it produced was unobtrusive.

To mount the Katana 775, users have to insert four plastic pins into the holes surrounding an LGA775 socket and push them down on said pins to lock them into place (just like a stock Intel cooler). Scythe didn't polish the heatsink's base to a mirror finish, but it was smooth and flat. The Katana 775 may not have put up the same kind of numbers as some of the more expensive units we looked at, but for $24 you can't go wrong.

Katana 775
$24
Scythe
www.scythe-usa.com
●●●●

Specs: Construction: aluminum and copper; Air Flow: 11.20 to 35.12cfm; Fan Connector: 4-pin; Fan Size: 92mm; Heatpipes: 2

Intel LGA775 Platform Cooling Performance: Stock & Overclocked

To test the Scythe Katana 775, Artic Cooling Freezer 7 Pro, and SilverStone Nitrogen NT06, I installed each heatsink on an Intel DX975XBX, 975X Express chipset-based motherboard with a brand-new Core 2 Extreme X6800 processor. Although the Core 2 architecture has proven to be much more powerful than the older NetBurst architecture, it's also more energy efficient, so any of these coolers are more than capable of keeping a Core 2 Duo's temperatures in check.

I used Intel's Desktop Control Center application to monitor temperatures throughout testing and a combination of Folding@Home and the SiSoftware Sandra's burn-in tests to put a load on the processor. I ran the Stock Idle and Stock Load tests with the processor clocked at its default frequency of 2.93GHz. However, I ran the Overclocked Idle and Overclocked Load tests with the processor clocked at 3.55GHz with a 1.425V core voltage. I recorded peak temperatures after approximately 30 minutes of idle or load time and ran each cooler's fan at its maximum speed where applicable.

As you can see from the chart, using SilverStone's Nitrogen NT06 resulted in the lowest temperatures, regardless of the test system configuration. Artic Cooling's Freezer 7 Pro came in a close second. (*NOTE: The temperatures in this chart are indicative of how the DX975XBX motherboard's BIOS interprets the data being read from the Core 2 Extreme X6800's internal thermal diode. Testing the same processor and coolers with a different motherboard could yield different results.*)

	*Stock Idle X6800 at 2.93GHz	*Stock Load X6800 at 2.93GHz	*Overclocked Idle X6800 at 3.55GHz	*Overclocked Load X6800 at 3.55GHz	Noise Level
Scythe Katana 775	43	58	53	65	12.00 to 31.65dBA
Artic Cooling Freezer 7 Pro	42	56	53	63	0.9 Sone
SilverStone Nitrogen NT06	39	53	51	60	21.0 to 42.2dBA

*In degrees Celsius

CPU RANKING ○ **0 = ABSOLUTELY WORTHLESS** | ●●◖ **2.5 = ABSOLUTELY AVERAGE** | ●●●●● **5 = ABSOLUTELY PERFECT**

Nitrogen NT06
$59
SilverStone
www.silverstonetek.com
●●●◖

Specs: Construction: aluminum and copper; Air Flow: 107.13cfm; Fan Connector: 4-pin; Fan Size: 120mm; Heatpipes: 3

Artic Cooling Freezer 7 Pro

Artic Cooling's Freezer 7 Pro has a machined copper base with copper heatpipes that run upward through an array of aluminum fins; much like Scythe's Katana 775. The design makes the Freezer 7 Pro relatively lightweight in comparison to an all-copper cooler, but because the cooler is measurably larger, it's a bit heavier. (Compared to the Katana, for instance, it weighs 529 grams vs. Katana's 315 grams.) The Freezer 7 Pro's larger size also gives this cooler an edge in surface area, which accounts for its better overall performance.

Thanks to the tried-and-true plastic pushpin design, the Freezer 7 Pro is as easy to install as Intel's stock cooler: Line the plastic pushpins up with the holes surrounding the socket and push them down to lock into place. Removing the heatsink is just as easy: Rotate the pins counterclockwise about 90 degrees and they pop right up. Its quietness, good performance, affordable price, and easy installation make the Freezer 7 Pro an excellent choice for a Core 2 Duo- or Pentium D-based system.

SilverStone Nitrogen NT06

The SilverStone Nitrogen NT06 has a number of interesting features, the most obvious is its enormous size. This is the only cooler I looked at in this roundup that has a large 120mm fan. Its heatpipes and base are somewhat unique, as well.

Although the Nitrogen NT06 doesn't look particularly wild (SilverStone equips it with a simple, square array of aluminum heatsink fins affixed to a trio of heatpipes), its bulk and brute force make up for it. To accommodate the large fan, the heatsink fins are very long, which gives this cooler a lot of surface area to dissipate heat. Even though the cooler has "only" three heatpipes, they are about double the diameter of the heatpipes on the other coolers in this roundup. The NT06 also features a small aluminum heatsink on its base to help heat dissipation; something I don't see very often.

Its performance may be very good, but the SilverStone Nitrogen NT06 is not without its faults. For one, when I cranked the included fan controller to its maximum setting, the fan was quite loud. According to the specifications, at its maximum speed the fan generates a sound pressure level of 42.2dBA and moves over 107cfm of air. At about a foot away, I measured almost 48dBA, but that was in a fully built system that featured a pair of GeForce 7900 GTX cards and dual-fan PSU. The NT06 is also the only cooler I tested that requires users to re-move their motherboard to install a custom mounting plate. This is kind of a pain for enthusiasts that upgrade often.

The NT06's nearly $60 price premium will surely limit its appeal, but as the saying goes: You get what you pay for. This is one powerful cooler.

Whether you're building a budget AM2 box or a decked out Core 2 Extreme rig, one of the coolers I've examined in this roundup is likely to fit your needs. Which one depends on your specific application, but I suspect quite a few of you are ready to throw down some hard-earned cash after seeing the kind of headroom my FX-62 and X6800 processor had left in the tank. ▲

by Marco Chiappetta

Freezer 7 Pro
$34
Artic Cooling
www.artic-cooling.com
●●●●

Specs: Construction: aluminum and copper; Air Flow: 45cfm; Fan Connector: 3-pin; Fan Size: 108mm; Heatpipes: 3

Intel Core 2 Duo E6700

Core 2 Duo E6700
$530
Intel
www.intel.com
●●●●

In March 1993, Intel released its new 586 processor under the Pentium brand name. Since that time, the best processors in Intel's lineup have borne some variation of the Pentium name. In 2001 Intel introduced NetBurst architecture along with its new Pentium 4 processor. Intel's focus on pushing clock speeds higher made NetBurst a good fit for the company at the time. As Intel continued pushing clock speeds higher, however, its processor became more energy hungry and produced a lot more heat. In 2004, Intel stopped development of its Tejas core, making it clear it had taken NetBurst as far as it possibly could. Intel shifted its focus away from clock speed and toward multicore processors that ran more efficiently than past processors. The release of Intel's new Core 2 Duo processor marks the end of NetBurst on the desktop.

The new Core 2 Duo processor uses the Conroe core and Intel's new Core microarchitecture in place of NetBurst. The result shows a significant performance increase over past models despite running at lower clock speeds. Core 2 Duo features two cores with 4MB of shared L2 cache. Intel's Advanced Smart Cache dynamically assigns more of the shared L2 cache to each core as needed. The Core 2 Duo also includes support for Intel's Wide Dynamic Execution, which lets each core execute up to four instructions per clock cycle. Intel's Smart Memory Access provides a new prediction algorithm that's more efficient at moving data from memory into the L2 cache. Finally, Intel's Media Boost can issue 128-bit SSE instructions once per clock cycle improving the processor's multimedia performance. EM64T and Execute Disable Bit are still present in the Core 2 Duo.

Performance

The real question is how does the Core 2 Duo perform? I tested an Intel Core 2 Duo E6700 (2.66GHz) with an Intel 975X motherboard. In my test system was 1GB of OCZ DDR2 memory and a BFG Tech GeForce 7950 GX2 video card. I also tested an Intel Pentium Extreme Edition 965 in the same test system. Like the Core 2 Duo, the Extreme Edition 965 is a dual-core processor that runs on the same quad-pumped 1,066MHz FSB. The 965 also includes 4MB of L2 cache, but it divides the cache evenly between both cores.

When it came to performance, the Core 2 Duo more than made up for what it lacked in clock speed. My Core 2 Duo E6700 posted an overall 3D-Mark06 score that was 911 points higher than the Extreme Edition 965. PC-Mark05 scores were a bit more interesting. The Extreme Edition posted a better PCMark05 CPU score, but I managed to post higher Memory and Graphics scores with the Core 2 Duo leading to a better overall PCMark05 score. I saw a big discrepancy in my application tests. The Core 2 Duo managed to crank out 19fps more in F.E.A.R. and managed to tear through my Dr. DivX test in less than six minutes. I managed to compress my 500MB WinRAR file in just a little more than three minutes.

As you can see from the chart, the Core 2 Duo proves that clock speed isn't everything. Both the Core 2 Duo and the Extreme Edition 965 use the same FSB and have the same amount of L2 cache (although the processors divide the cache differently). Despite the Extreme Edition 965's faster clock speed, the Core 2 Duo's new Core microarchitecture showed better performance on nearly every test.

When pair with the Core 2 Extreme X6800, Intel's D975XBX motherboard provides options to adjust the processor's multiplier and the motherboard's FSB. With the E6700, however, those options disappear. As a result, I was unable to overclock the E6700 on the Intel D975XBX motherboard. ▲

by Chad Denton

Benchmark Numbers

Intel Core 2 Duo 6700

FSB	Multiplier	Clock Speed	Memory	3DMark06	SM2.0	HDR/ SM3.0	CPU Score	PCMark05	CPU	Memory	Graphics	HDD	F.E.A.R.	*Dr. DivX	*WinRAR (500MB Compression)
1,066MHz	10	2.66GHz	533MHz	8031	3630	3478	2080	6446	6238	5409	7496	4307	96	5:47	3:12

Intel Pentium Extreme Edition 965

FSB	Multiplier	Clock Speed	Memory	3DMark06	SM2.0	HDR/ SM3.0	CPU Score	PCMark05	CPU	Memory	Graphics	HDD	F.E.A.R.	*Dr. DivX	*WinRAR (500MB Compression)
1,066MHz	14	3.73GHz	533MHz	7120	2921	3198	2046	6207	6422	4691	6673	4312	77	7:39	4:00

* Minutes:Seconds

Specs: 2.66GHz clock speed, 1,066MHz quad-pumped FSB, 0.065-micron manufacturing process, 4MB L2 cache (dynamically allocated)

CPU RANKING ○ **0 = ABSOLUTELY WORTHLESS** | ●●◖ **2.5 = ABSOLUTELY AVERAGE** | ●●●●● **5 = ABSOLUTELY PERFECT**

Intel Core 2 Extreme X6800

Core 2 Extreme X6800
$999
Intel
www.intel.com
●●●●

Intel's new Core 2 Duo platform marks a major shift in the company's strategy. Not only is the Pentium name gone, but so is Intel's power-hungry NetBurst architecture. At the same time Intel introduced its new Core 2 Duo platform, Intel also introduced its new Core 2 Extreme.

Typically, Intel's Extreme processors support faster FSB speeds and/or additional L2 cache. This isn't the case for the Core 2 Extreme. Like the Core 2 Duo, the Core 2 Extreme includes 4MB of L2 cache that's dynamically allocated between the two cores. The Core 2 Extreme also runs on the same 1,066MHz FSB. The new Conroe core the Core 2 Extreme uses supports Intel's Wide Dynamic Execution and Smart Memory Access in addition to standard features such as EM64T and Execution Disable Bit.

So what exactly does the Intel Core 2 Extreme have to offer over the Core 2 Duo? Clock speed for one. The Core 2 Extreme X6800 I looked at runs at 2.93GHz. The Core 2 Extreme also targets overclockers with an unlocked multiplier. I was able to overclock the Core 2 Extreme to 3.46GHz on an Intel D975XBX motherboard by increasing the multiplier from 11 to 13. By increasing the FSB to 1,333MHz, I was able to get the Core 2 Extreme X6800 stable at 3.67GHz; although, I did have to increase the processor's voltage to 1.5750V (from 1.4000V) and increase the PCI Express frequency to 103.96MHz.

Performance

I tested the Core 2 Extreme X6800 and compared its performance with an Intel Pentium Extreme Edition 965. The Extreme Edition 965 runs on a 1,066MHz FSB like the Core 2 Extreme, but runs at a faster 3.73GHz. I also used a BFG Tech GeForce 7950 GX2 and 1GB of OCZ DDR2 memory.

The Core 2 Extreme's overall 3DMark06 score was more than 300 points better than the Core 2 Duo's score and more than 1200 points better than the Extreme Edition 965. The Core 2 Extreme's 3DMark06 CPU score stood out above the other two processors.

Although the Core 2 Extreme posted better PCMark05 Memory and Graphics scores than the Extreme Edition 965, the Core 2 Duo E6700 did receive a slightly better Graphics score.

Increasing the multiplier to 13 actually decreased my 3DMark06 and PCMark05 CPU scores significantly, resulting in lower overall scores for both. I did notice significant increases in my PCMark05 Memory and Graphics scores, however.

Increasing the FSB to 133MHz and leaving the multiplier at 11 gave me a 3.67GHz clock speed. This combination proved more fruitful, as I saw performance increase across the board. Performance scores for 3DMark06 improved slightly over my stock scores. PCMark05 scores, however, were much improved, especially the CPU score. Memory scores did suffer a bit, but my other component scores made up for the slight decline. I saw the same frame rates in F.E.A.R. as I saw when increasing the multiplier, but I saw dramatic gains in my Dr. DivX test breaking the 4:30 mark. My WinRAR score was slightly better than my stock score, but it was a bit worse than I saw when increasing the multiplier.

Although I loved the scores the Core 2 Extreme posted, I have to wonder whether the processor is worth $400 more than the Core 2 Duo. Overclockers will certainly be drawn to the Core 2 Extreme more than the Core 2 Duo for its unlocked multiplier, but at default clock speeds I don't see enough of a performance gain to justify $400 more in the price. ▲

by Chad Denton

Benchmark Numbers

Intel Core 2 Extreme Edition X6800

FSB	Multiplier	Clock Speed	Memory	3DMark06	SM2.0	HDR/ SM3.0	CPU Score	PCMark05	CPU	Memory	Graphics	HDD	F.E.A.R.	*Dr. DivX	*WinRAR (500MB Compression)
1,066MHz	11	2.93GHz	533MHz	8343	3634	3481	2470	6921	7449	5800	7194	4829	97	5:29	2:59
1,066MHz	13	3.46GHz	533MHz	7934	3631	3468	1974	6517	6112	6251	7710	4314	100	5:16	2:49
1,333MHz	11	3.67GHz	533MHz	8486	3646	3489	2663	7577	8134	5620	7802	4305	100	4:27	2:55

Intel Pentium Extreme Edition 965

FSB	Multiplier	Clock Speed	Memory	3DMark06	SM2.0	HDR/ SM3.0	CPU Score	PCMark05	CPU	Memory	Graphics	HDD	F.E.A.R.	*Dr. DivX	*WinRAR (500MB Compression)
1,066MHz	14	3.73GHz	533MHz	7120	2921	3198	2046	6207	6422	4691	6673	4312	77	7:39	4:00

* Minutes:Seconds

Specs: 2.93GHz clock speed, 1,066 quad-pumped FSB, 0.065-micron manufacturing process, 4MB L2 cache (dynamically allocated)

CPU RANKING ○ 0 = ABSOLUTELY WORTHLESS | ●●◖ 2.5 = ABSOLUTELY AVERAGE | ●●●●● 5 = ABSOLUTELY PERFECT

Dell UltraSharp 2407WFP

By now, you've probably drawn up a list of components for your Vista-compatible PC. Unless a 30-inch, widescreen display is a must-have, cross off the LCD that's currently on your list and replace it with Dell's UltraSharp 2407WFP. Not only do the 2407WFP's sharp aesthetics match its sharp images, but also it has accessories to please peripheral-hungry power users.

In addition to a slew of video inputs (DVI-D, analog, component, S-Video, and composite), this 24-inch, widescreen LCD includes an integrated 9-in-2 media card reader and 4-port USB hub (two ports on the side and two on the back of the panel). A superb display doesn't require extra goodies, but having these bonuses definitely earns the 2407WFP style points.

The 2407WFP confronted my collection of tests, which consisted of DisplayMate's Multimedia Edition software for overall quality, F.E.A.R., and an HD teaser for "Spider-Man 3."

In DisplayMate's MultiMedia Edition, the 2407WFP seemed to struggle with color contrast, and whites were slightly warm. However, it excelled in most other tests, displaying crisp fonts and showing very dark blacks with exceptional grayscale contrast.

The LCD turned in similarly good results when I used it to run through a few levels of F.E.A.R. The 2407WFP's impressive black level was apparent in the game's dimly lit areas, and there were no ghosting problems to plague my overall gameplay experience.

I'd recommend the display as an affordable means to an HD end. I was expecting saturated reds in "Spider-Man 3" but the 2407WFP surprised me with remarkably accurate color and detail. Two DVI inputs would have been the icing on the cake, but I'll admit this is a minor objection tacked to the end of a long list of praises.

The 2407WFP has no glaring weakness and remains true to Dell's typical practice of releasing quality monitors that don't explode your budget. It's a great display now and should be a terrific Vista display in the near future. ▲

by Vince Cogley

Specs: 1,920 x 1,200 resolution, 1000:1 contrast ratio, 450 cd/m2 brightness, 9-in-2 media card reader

UltraSharp 2407WFP
$879
Dell
www.dell.com
●●●●◖

HP LC3760N 37-inch HD LCD TV

If you want to pay close to two grand for a flat-screen LCD, you might want to consider the HP LC3760N 37-inch HD LCD TV. It has enough connectors to keep you busy for the better part of the day hooking up everything you own, the picture is beautiful, and it doesn't take up much space; it's less than 6 inches deep. It comes with a simple stand, or you can mount it on your wall.

The LC37760N has a clear picture with a high contrast ratio, excellent response time, and wide viewing angle that delivers a great analog TV picture, as well as HD. Its widescreen format means you'll be able to enjoy movies more, as well. The two built-in speakers are conveniently placed on the front of the unit, but for real 3D surround sound you'll want to connect the set to a receiver and at least a 5.1 speaker setup. The remote is amazingly simple to use and logically arranged for something that does so much.

Even though the LC3760N supports 480p, 720p, and 1080i modes, you don't want to use this TV to just receive over-the-air programming and should, if you don't already, subscribe to HD cable or satellite services. Over-the-air HD isn't very satisfying unless you're lucky enough to live close by the transmitting stations and don't mind fussing with the space-age antenna (not included) that you'll need to pull down the signal. ▲

by David Strom

LC3760N 37-inch HD LCD TV
$1,899
HP
www.hp.com
●●●

Specs: 16:9 aspect ratio, 1,366 x 768 pixels, 0.258 pitch, 1,200:1 contrast ratio, 6ms response time, 2 HDMI (High-Definition Multimedia Interface), 2 HD component AV, 1 S-Video, 3 composite video, 176 degree viewing angle, 53 pounds

CPU RANKING ○ 0 = ABSOLUTELY WORTHLESS | ●●◖ 2.5 = ABSOLUTELY AVERAGE | ●●●●● 5 = ABSOLUTELY PERFECT

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Vantec NexStar LX NST 375LX

Users looking for an easy way to add some portable storage to their networks will likely be intrigued by Vantec's latest hard drive enclosure, the NexStar LX NST 375LX. The NexStar LX isn't only an external USB 2.0 hard drive enclosure, but it's also a NAS box.

Like other enclosures in Vantec's storage product lineup, the NexStar LX doesn't include a hard drive; you'll have to purchase a drive separately or recycle one from your spare parts pile. The NexStar LX supports drives as large as 500GB.

Assembling the device requires nothing more than disengaging the plastic lid, connecting the drive to data and power cables, securing it in place with some screws, and snapping the unit back together. I should note that unlike most other NAS devices, you have to format the hard drive in the LX using the FAT32 file system, so it will be prone to fragmentation. I'd recommend connecting the unit directly to a PC for defragging every month or so.

You can connect the NexStar to a PC via USB or Ethernet cables, or connect it to a hub or switch and share it over a network. To configure the device, you must use a Web browser, which is similar to the way most SOHO broadband routers are set up. This hard drive enclosure also incorporates FTP and SMB server functionality.

The NexStar LX features a large heatsink and an integrated cooling fan. Also, the unit comes bundled with a detailed users manual; power, USB, and Ethernet cables; mounting screws; and a driver CD (for Windows 98/SE only). ▲

by Marco Chiappetta

Specs: Hard Drive Support: 3.5-inch IDE (PATA), up to 500GB; Interface/Ports: IDE to USB 2.0 or RJ-45; LAN Speeds: 10Mbps, 100Mbps, or 10/100Mbps; OS Support: Windows and Mac OS; Dimensions: 16.51 x 16.51 x 5.08cm (HxWxD)

NexStar LX NST 375LX
$73.99
Vantec
www.vantecusa.com
●●●●

Sunbeamtech NUUO Series 550W SLI PSU

NUUO Series 550W SLI PSU
$79
Sunbeamtech
www.sunbeamtech.us
●●◖

Sunbeamtech's NUUO Series of power supplies recently landed on Nvidia's Certified Power Supplies list (for configurations below a pair of 512MB 7800 or 7900 GTX cards). I tested a NUUO Series 550W PSU with a pair of GeForce 7900 GTX cards, however, and didn't have any trouble. In fact, under heavy load with a pair of GTXs installed, the PSU's rails rarely fluctuated more than a 0.1V or 0.2V.

The Sunbeamtech NUUO Series power supplies feature dual 12V rails (30A and 35A max), a modular cabling system, and a temperature monitor/fan controller. The 550W model I tested came with a trio of modular cables that were each equipped with three 4-pin Molex connectors, a 4/8-pin ATX 12V cable, an EMI shielded 6-pin PCI Express graphics power cable, two modular SATA power cables (each with a pair of connectors), and an EMI shielded 4-Pin Molex power cable. Along with these items, Sunbeamtech includes dual 4-pin Molex to 6-pin PCI-E and a single 4-pin Molex to dual-floppy power adapters. The large 24-pin power cable isn't modular.

The bundled fan controller/temperature monitor is simple but useful. You can mount it in any external 3.5-inch bay, and it features a small LCD that scrolls fan conditions and temperatures from inside the PSU and directly from the surface of the main PSU heatsink. At the lowest setting, the NUUO 550W's 120mm and 80mm fans were quiet, but at the highest setting they were somewhat louder than a typical CPU cooler.

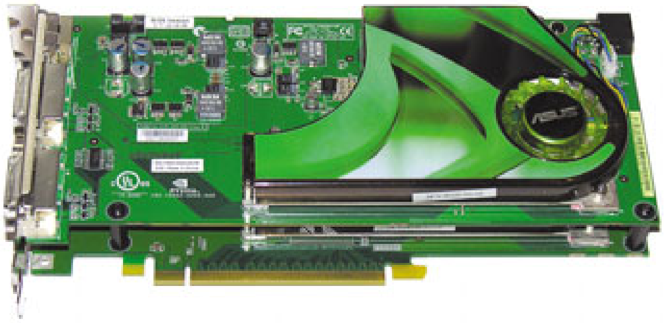
Sunbeamtech's NUUO 550W SLI PSU worked well throughout testing, and it's a great value. However, a PSU on Nvidia's Dual Ge-Force 7900 GTX certified list will probably better serve power users looking for a beefy PSU for a high-end SLI rig. ▲

by Marco Chiappetta

Specs: AC Input: 100V ~ 120V, 10A, 60Hz; DC Output: 3.3v=28A, +5v=36A, +12v1=30A, +12v2=35A, -12v=0.8A, +5VSB=2.5A; Max Combined Wattage: 562W; Efficiency: >72% at full load, >62% at light load; Fans: 80mm, 120mm, 15 dbA minimum; Active PFC

CPU RANKING ○ **0 = ABSOLUTELY WORTHLESS** | ●●◖ **2.5 = ABSOLUTELY AVERAGE** | ●●●●● **5 = ABSOLUTELY PERFECT**

Asus EN7950GX2



Adorned with the fierce and mighty face of the legendary King Kong smack-dab on the front of its box, Asus brings to market its own incarnation of the omnipotent GeForce 7950 GX2. The launch of Nvidia's double-stacked, dual GPU, high-end graphics card design back in June was met with a great deal of enthusiasm from both users and the media. After all, the GeForce 7950 GX2 essentially is all the power of two 512MB of RAM-equipped GeForce 7900 GTs preconfigured into a single PCI Express slot, offering nearly double the performance.

Of course the average GeForce 7950 GX2 is also double the price as one would expect, so stepping up to one of these bad boys means you'll need to have a serious commitment to gaming. The Asus flavor of 7950 GX2 that I tested is a straightforward reference design with no deviation from the Nvidia specification. It has a 500MHz core GPU clock with a 600MHz (1.2GHz DDR3) memory interface speed. It also sports an identical PCB layout to virtually every GeForce 7950 GX2 I've seen to date.

The top-layer board consists of a daughter card-style design that sits on top of the base card with a mezzanine-style circuit board edge connector between the two. Each card has its own GeForce 7900 GPU and the base card has a custom Nvidia 48 lane PCI-E switch on board that allows inter-GPU communication in SLI, as well as a x16 PCI-E connection into a single slot on your motherboard.

At the time of this writing, Nvidia still wasn't "officially" supporting two of these boards linked together in Quad SLI mode; however, without question you can do it, depending on the model of your motherboard. Asus' A8N series of motherboards all reportedly do work with Quad SLI, and Nvidia makes the feature available with its 91.xx driver series release. I tested two EN7950GX2s together in Quad SLI on an Asus A8N32 SLI motherboard and saw significant gains in games such as F.E.A.R., Half-Life 2, and Quake but little to no benefit in the few other titles I tested. Nvidia is obviously still tweaking its drivers.

Beyond that, the benchmark scores (see the chart) speak for themselves. The Asus EN7950GX2 performs right on par with any stock GeForce 7950 GX2. The card has street price listings of around $609 with a few e-tailers, which drops in on the higher end of the pricing scale currently. In addition, there are 7950GX2 offerings from the likes of XFX and others that come factory overclocked out of the box, while the EN7950GX2 is locked in at Nvidia reference design speeds.

However, I found in testing that the card was able to hit overclocked speeds of 580MHz core and 800MHz (1.6GHz DDR) memory with good stability. These speeds, of course, aren't under Asus' warranty. What's perhaps the most distinguishing feature of the Asus EN7950GX2 is its excellent bundle, with the major game title King Kong and a few other minor offerings such as Splendid's image-quality software tossed in for good measure. All told, the Asus EN7950GX2 is a monster of a card without question and it ripped through our benchmarks like an overgrown angry gorilla. ▲

by Dave Altavilla

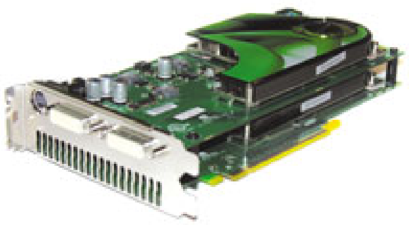
BENCHMARK DIGITS

	Radeon X1900XTX	GeForce 7900 GTX	Reference GeForce 7950 GX2	Asus EN7950GX2
3DMark06	5964	6060	7879	7915
3DMark06 HDR/SM3.0	2611	2479	3460	3458
Splinter CT (1,600 x 1,200; 4XAA)	64.53	60.92	86.86	86.89
Splinter CT (1,920 x 1,200; 4XAA)	56.38	52.48	75.13	75.19
Half Life 2: Lost Coast (1,920 x 1,200; 4XAA)	62.59	84.35	87.6	87.7
F.E.A.R. (1,600 x 1,200; 4XAA)	50	48	68	69
Quake 4 (1,600 x 1,200; 4XAA)	49.4	56.5	83.1	83.2
Oblivion (1,920 x 1,200; HDR/No AA)	34.13	35.23	38.4	38.42

** 2 Asus EN7950 2 in Quad SLI: Half Life 2 Lost Coast, 109.1; F.E.A.R., 95; Oblivion, 41.31

Specs: Dual GeForce 7900 GPUs, 500MHz core speed, 1GB of 600MHz GDDR3 DRAM (1.2GHz, 512MB per GPU), 16 vertex shaders, 48 pixel shaders, PCI-E x16 interface, single PCI-E power connector

***System Specs:** AMD Athlon 64 FX60, Asus A8N32 SLI (nForce 4 SLI x16 chipset), 2GB Corsair XMS PC3200 DDR, onboard sound



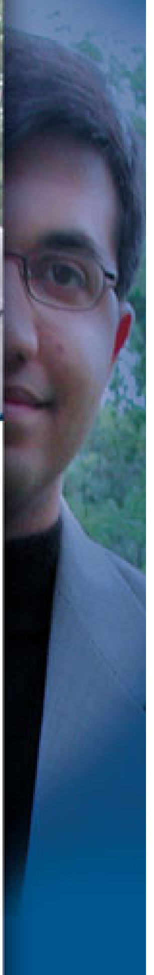
EN7950GX2
$609
Asus
www.asus.com
●●●●

CPU RANKING ○ 0 = ABSOLUTELY WORTHLESS | ●●◖ 2.5 = ABSOLUTELY AVERAGE | ●●●●● 5 = ABSOLUTELY PERFECT

Intel Is Good Again

by Anand Lal Shimpi

Anand Lal Shimpi has turned a fledgling personal page on GeoCities.com into one of the world's most visited and trusted PC hardware sites. Anand started his site in 1997 at just 14 years old and has since been featured in USA Today*, CBS' 48 Hours and* Fortune*. His site—www.anandtech.com—receives more than 55 million page views and is read by more than 2 million readers per month.*



After years of waiting for a great product to truly restore confidence in its name, Intel finally unveiled the performance of its Core 2 line of processors on July 14th. In quite possibly the most important and successful product launch of the past decade, Intel truly cleaned up shop with Core 2.

At the very high end, Intel's Core 2 Extreme X6800 puts AMD's entire FX and X2 processor lines to shame. For the first time since Intel and AMD started this fad of $1,000 "extreme" processors, Intel finally has a part that isn't a total waste of money. While I'd still recommend picking the next lowest speed grade and cutting the price of the CPU almost in half, you do get a factory unlocked processor and a higher stock clock speed with the Core 2 Extreme. And unlike previous Intel Extreme Edition CPUs that were marketed as the "world's fastest," this one actually is.

But the truly impressive part of Intel's Core 2 lineup isn't at the very high end, but rather the 2.4GHz E6600. The E6600 is faster than AMD's flagship Athlon 64 FX-62, and at just $316 costs less than 1/3 as much. At 2.4GHz, chances are you'll have no problems overclocking the CPU to close to the 2.93GHz of the more expensive X6800 by increasing FSB frequency alone.

By maintaining a fairly short 14-stage pipeline (compared to the 31-plus stages of Intel's Pentium D), Intel was able to significantly reduce power consumption and increase performance per clock at the expense of being able to reach high clock speeds. However, when you look at how far you can overclock the new Core 2 processors, we're not that far off of Pentium D speeds. (3.4GHz is readily attainable assuming you've got good air cooling, and I've seen clock speeds of around 4GHz with some really good heatsinks.) It's not that the 65nm Core 2 processors don't follow the laws of microprocessor physics; it's that the 65nm Pentium D processors were running into thermal limitations before they could ever reach their true peak clock speeds. It's the thermal wall that the Pentium D and its NetBurst architecture hit that originally forced Intel down the path of its Core architecture.

Some other important findings that I've come across in my Core 2 testing:

Intel offers Core 2 processors with either 4MB or 2MB of L2 cache, shared between the two cores. The 4MB option can yield a performance boost of up to 10% in some cases and will only get more and more important as working data sets grow larger. The problem is that the cheapest 4MB part is the E6600 at $316, while the E6300 and E6400 are both priced at around $200 ($183 for the 6300 and $224 for the E6400). You've got to do your own cost benefit analysis to figure out which CPU is right for your budget and upgrade path.

All of Intel's Core 2 processors run off of a 1,066MHz FSB, however its Xeon counterparts feature up to a 1,333MHz FSB. The performance benefit you get from a faster FSB on Core 2 is also pretty decent, although it's not as large as the boost the 4MB cache offers vs. 2MB.

Based on my testing, while DDR2-800 looks nice on paper, it's simply not necessary to get the most performance out of your system. As long as you've got low-latency memory modules, DDR2-667 will perform just as well as DDR2-800. The explanation behind this is simple: Core 2's FSB runs at 1,066MHz but is only 64 bits wide, delivering 8.53GBps of bandwidth to the CPU. Core 2's memory subsystem is 128 bits wide but even at DDR2-667 can deliver 10.67GBps of bandwidth, meaning that unless its FSB frequency is faster than 1,333MHz, the CPU can't use any more memory bandwidth.

I'm still waiting to see what availability is going to be like, but if you can get one, Intel's Core 2 can't be beat. As for planning against obsoleteness, Intel won't be releasing any new Core 2 products this year, but early next year expect to see a quad-core version replace the X6800. ▲

> You've got to do your own cost benefit analysis to figure out which CPU is right for your budget and upgrade path.

Talk back to Anand@cpumag.com.

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The Shark Tank

by Alex "Sharky" Ross

Got A Socket AM2?

It's not been the most exciting year for AMD thus far, but that may change if all of those Dell rumblings actually come to pass. Gaming-wise the company still offers the best products for the more hardcore enthusiasts. Even so, AMD's recent AM2 processor launch was received with a rather drab reception even though many of us bought into the initial hype. Nonetheless it's here, and every CPU needs a homely platform. The good news is that there are two new ("newish" to be perfectly correct) platforms available from the usual crew: Nvidia and ATI.

First up is Nvidia, who already holds a significant market share lead in the Athlon 64 sector. With the nForce 5, Nvidia intends to keep its lead with the likes of the new 590 SLI chipset. There are, however, three other flavors: 570 SLI, 570 Ultra, and 550 for lesser mortals.

The 590 SLI is very similar to the Socket 939-based nForce 4 SLI X16 platform that came before it. As is customary, this nForce platform sports two "new" chips: the C51XE SPP (System Performance Processor) and the MCP55PXE (Media and Communications Processor). These chips are connected to the CPU via a HyperTransport bus. Only the 590 SLI serves up dual x16 PCI Express lanes for your favorite dual-graphics card setups (there are a total of 46 PCI lanes).

There is also a plethora of features Nvidia adds to the nForce 590 SLI (some via software) that weren't available with the nForce 4 SLI chipset. The most talked about is LinkBoost, which can automatically increase the PCI-E and MCP HyperTransport speeds by 25%. Instead of 8GBps available between each PCI-E and HT bus link, you'll now have 10GBps on tap. However, Nvidia only guarantees "certified" graphics cards as being able to do this and funnily enough the only one is the 7900 GTX.

Other nForce 590 SLI features include: FirstPacket, which is designed to let you set up network data packets for latency-intensive games in order to give you a better ping. Throw in DualNet (a bunch of server-level teaming, TCP/IP acceleration, and CPU utilization stuff), improve MediaShield functionality (there are now three separate SATA controllers each with dual PHYs able to run at 1.5Gbps or 3Gbps and added RAID support), and create a much better nTune 5.0 control panel, and you can see Nvidia has actually sweetened the deal over the nForce 4 SLI. Oh, and best of all, Nvidia has finally dumped AC'97 and accelerated itself into the present in which sound is concerned and added high-definition audio with Azalia support. You can find motherboards based upon the 590 SLI chipset in the $200 price range.

ATI is newer to the chipset game and until recently has lagged behind Nvidia in terms of features and performance; not so nowadays, though. If CrossFire and Radeons are more your cup of tea and biscuits, then ATI also has a "new" AM2-based platform on offer dubbed the Xpress 3200. Actually ATI has previously used the Xpress 3200 name, and the only real change between the two platforms comes in the form of the southbridge, which ATI has replaced with SB600. (Nvidia has acquired ULi, who used to make southbridge chips for ATI, but in all honesty the previous SB450 was not something that I or many ATI users will miss.) The SB600 features much-improved Serial ATA and USB 2.0 controllers and retains Azalia support. The SB600 southbridge is connected to the RD580 northbridge via the A-Link Xpress II bus (think PCI-E X4 here), which maxes out at 2Gbps. ATI's offering does seem a little less exciting on paper, but it's certainly no slouch when it comes to performance and only slightly behind Nvidia's offering.

Clearly, owning an AM2 processor does not seem all that trendy right now. Pair it up with one of these platforms from Nvidia or ATI, however, and you're still no worse off than any Socket 939 user. ▲

Email me at sharky@cpumag.com

Disrupting Reuters' newswire with a cheery Christmas greeting at age six, Alex "Sharky" Ross became an avid computer user/abuser, eventually founding popular hardware testing/review Web site SharkyExtreme.com. Exposing shoddy manufacturing practices and rubbish-spouting marketing weasels while championing innovative products, illuminating new technology, and pioneering real-world testing methods was just a front for playing with the best toys. The site acquired, he left in 2001. A London native and London School of Economics graduate, Alex currently overclocks/tunes Porsche 996 Turbos with www.sharkwerks.com when he's not tweaking PCs.

AMD's recent AM2 processor launch was received with a rather drab reception even though many of us bought into the initial hype.

PC Modder

Tips & Tutorials

Modding does the body good. A PC's body anyway, inside and out. Here you'll find hardware, firmware, tools, tips, and tutorials for modding your rig's performance and appearance. Send us your own mod-related tips and ideas at modding@cpumag.com.

Modding enthusiasts have a penchant for the latest toys. Fast processors, powerful video cards, silent SFF enclosures, and radically lit motherboards are all fair game when it comes to a modder's creative mind. Recognizing the appeal of unconventional customization, an entire industry has emerged to support the community.

Mods & Ends

Zalman CNPS9500 AM2 CPU Cooler

If you jumped right on the Socket AM2 bandwagon and need a high-performance air-cooler, Zalman's new CNPS9500 AM2 may fill the bill. The CNPS9500 AM2 ($69.99) is constructed 100% from copper and has a nickel-coated finish for maximum heat transferring. The cooler also has a curved, triple-heatpipe design that performs much like six individual pipes.

Considering its enormous size and all-copper construction, the CNPS9500 AM2 is relatively light, weighting just about 19 ounces. Part of the unit's light weight is due to its 0.0079-inch, ultra-slim heatsink fins, which also offer superior airflow resistance. Due to its large size, however, not every case may be compatible with the cooler. At about 5 x 4.4 x 3.35 inches (HxWxD), the CNPS9500 dwarfs the stock retail cooler that AMD provides. Included with the CNPS9500 AM2 is one of Zalman's Fan Mate 2 rheostats, which lets you control the speed of the cooler's integrated 3.6-inch lighted fan. The cooler is compatible with Opteron, Athlon 64 X2 Dual-Core, Athlon 64 FX-62, Athlon 64, and Sempron processors for AM2, 754, 939, and 940 sockets.

It didn't take long for Zalman to release a high-performance cooler for AMD's new Socket AM2 platform.

Coollaboratory Liquid Pro Thermal Interface Material

For maximum cooling performance, regardless of whether you're using air or liquid cooling, a good TIM (thermal interface material) is a must. Without a good TIM, heat won't efficiently transfer from your CPU or GPU to its heatsink, which could result in overheating. To that end, Coollaboratory bills its Liquid Pro Liquid Metal Thermal Interface Material ($14.99) as the ultimate way to mate a heatsink with a CPU. What makes Liquid Pro special is that the company claims it's a true liquid metal that's 100% metal alloy, and it covers most metals easily. Like mercury, Liquid Pro will remain in a liquid state at room temperature, but it isn't poisonous, unlike mercury.

Coollaboratory's Liquid Pro Thermal Interface Material is made of a 100% liquid metal alloy.

According to Coollaboratory, Liquid Pro contains no nonmetallic additives, including silicone or oxides, and it has no solid components, either. Coollaboratory claims the liquid's composition will outperform other TIMs made of mostly solids with additives for filler. Liquid Pro is designed for use with coolers made of highly conductive metals such as copper, nickel plated copper, silver, or gold. You can't use it with aluminum, however—unless you want to turn your aluminum heatsink into powder.

Sunbeam Technology Multi Fan Power Port

If you're looking for an easy way to power multiple case fans without the mess of multiple wires and without having to worry about how many headers there are on your motherboard, you'll likely be interested in Sunbeam's new Multi Fan Power Port ($13). To use the hub, you just plug a Molex connector into the hub. The unit's six LEDs will light up to show if power is being supplied to the hub. If so, just plug the case fan into an available header on the hub and you're ready to go. You can then mount the hub virtually anywhere in a case using included adhesive tape.

You can power six 3-pin fans from a single Molex connector with Sunbeam Technology's handy multifan hub.

Fashionably Fresh Firmware

Casio EX-Z1000 (v1.01)

A firmware update for the Casio EX-Z1000 fixes a problem that caused incorrect color reproduction in images recorded in overcast weather and in other conditions outdoors that produced poor lighting.

world.casio.com

Lite-On SHW-160H6S (vCS07)

This recently released firmware update from Lite-On for the SHW-160H6S CD/DVD-R drive improves compatibility with more types and brands of media.

us.liteonit.com

by Marco Chiappetta

GeForce 7800 GT Voltage Mod

The Making Of A Mainstream Powerhouse

Anytime a quick-and-easy method to increase performance presents itself, we immediately begin to explore and experiment with that technique to see if it results in real-world benefits—and to determine if we can take things to the next level with our own tweaks. Such was the case when a recent soft-mod for the GeForce 7800 GT cropped up on the Web.

Using a couple of readily available utilities, many GeForce 7800 GT owners soft-modded their cards' BIOS to increase the voltage supplied to the GPU without having to remove the card from their systems, with the benefit being that the increased GPU voltage allowed for higher overclocks. After experimenting with a couple of GeForce 7800 GT cards, we confirmed the mod does work and that it's relatively easy to do.

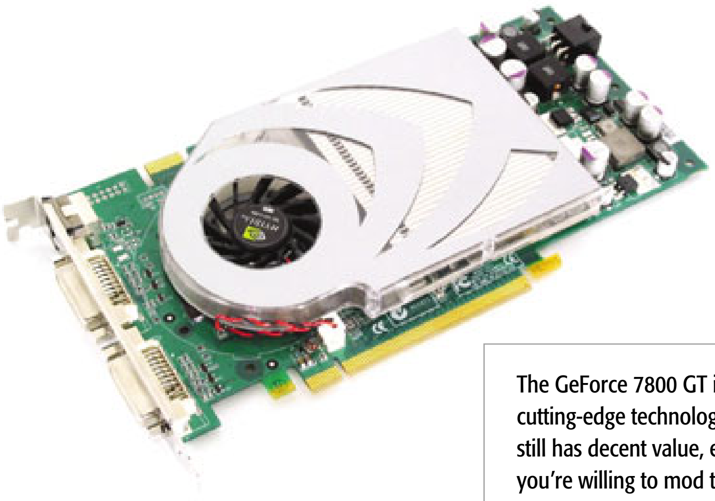
For typical *CPU* readers, though, a simple soft-mod isn't enough. Thus, we took a 7800 GT card of our own and enhanced it in a couple other ways to see just how fast we could make it.

Cool 'N Quiet–The Arctic Cooling Way

Although we had varying degrees of success with this soft-mod using our stock GeForce 7800 GT cards, anytime the supply voltage is increased to a component it is a good idea to augment or upgrade the associated cooling system, as increasing the supplied voltage typically results in higher temperatures. Enhancing the cooling alone will also usually let you overclock higher, so better cooling in conjunction with the volt-mod should make the end result that much better.

To bolster our GeForce 7800 GT's cooling, we opted for Arctic Cooling's slick Accelero X1 VGA cooler. The Accelero X1 included everything necessary for installation, including thermal grease, thermal pads, and mounting screws. To install the Accelero X1, we first detached our 7800 GT's stock cooler by removing a few screws and gently prying the cooler from the board. We then used some cotton swabs and isopropyl alcohol to thoroughly clean the surfaces of the GPU and onboard RAM chips.

At this point, we affixed new thermal pads to each of the card's RAM chips and put the Accelero X1 in place, taking care to not disrupt the thermal interface material on the cooler. Next, we secured the Accelero X1 in place using the supplied screws and plastic washers. Before reinstalling the card in the system, we also ensured that the Accelero X1 was making good contact with the GPU and RAM.



The GeForce 7800 GT is no longer cutting-edge technology, but it still has decent value, especially if you're willing to mod the card to gain higher performance.

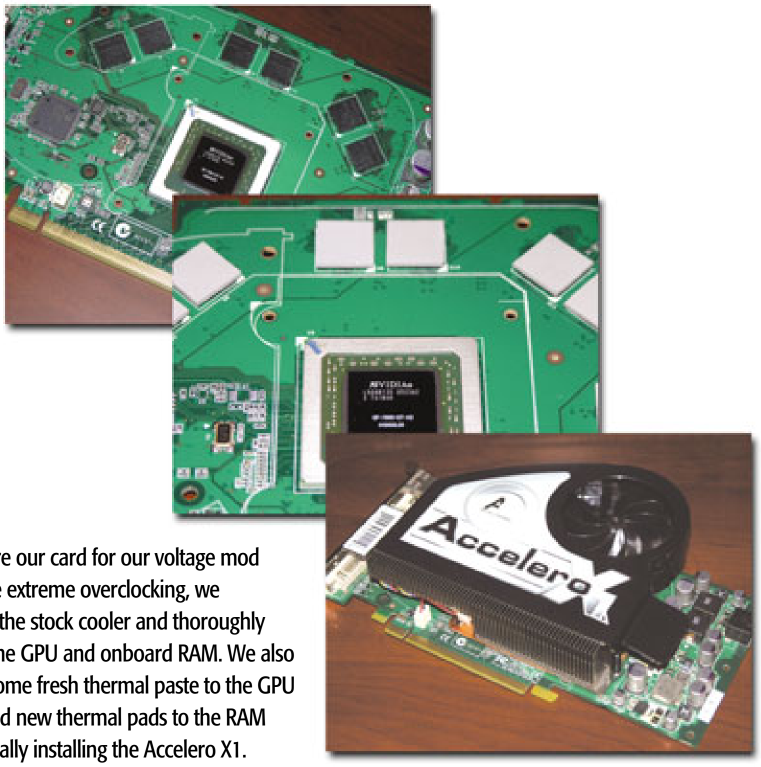
The Soft-Mod

After upgrading the GeForce 7800 GT's cooling, we performed the soft-mod to increase the GPU's voltage. To carry out the mod, we needed a bootable floppy and two utilities, including the Nvidia BIOS editor NiBiTor and nvFlash, a tool for flashing the video BIOS on Nvidia graphics cards. Both utilities are available from multiple locations online, but check MVKTech.net for the latest versions of each. For reference purposes we used version 2.9a of NiBiTor and 5.36 of nvFlash.

To mod the 7800 GT's BIOS, you'll need to boot into Windows and launch NiBiTor. Navigate to the program's Tools menu, click the Read BIOS option, and click Select Device. A dialog box will open, from which you'll select your GeForce 7800 GT card from the list. (Your 7800 GT will likely be the only card listed.) Next, click OK.

Arctic Cooling's Accelero X1 is quieter and more powerful than the stock cooler that the 7800 GT includes.

Now, go back to the Tools menu and select the Read BIOS option again. Select Read Into NiBiTor. This will probe the video card's BIOS and import all the parameters into the program. Next, click the Voltages tab and click the OK button on the warning message that will likely appear. On the Voltages tab, check the Extend Voltage Table box and click OK again if a warning message appears. Under the 3D drop-down menu, select



To prepare our card for our voltage mod and some extreme overclocking, we removed the stock cooler and thoroughly cleaned the GPU and onboard RAM. We also applied some fresh thermal paste to the GPU and affixed new thermal pads to the RAM before finally installing the Accelero X1.

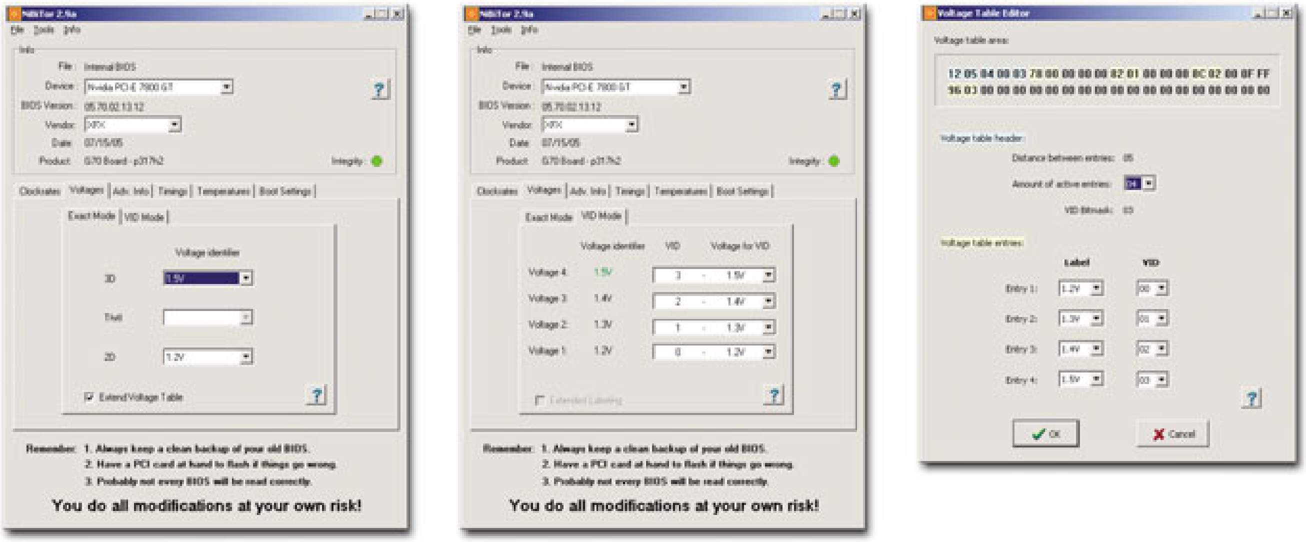
Performance Profile: Tweaked, Overclocked & Ready To Rock

We tested our modded GeForce 7800 GT with a handful of popular games and benchmarks to see what kind of effect the mods and overclocking had on its performance. We benchmarked the card in three different configurations, including at stock settings, stock and overclocked, and modded and overclocked. Additionally, to give you an idea of how our modded 7800 GT compares to more expensive cards, we also threw in scores from a GeForce 7900 GTX.

For testing, our system included two 2.6GHz AMD Athlon 64 FX-60 CPUs, an Asus A8N32-SLI Deluxe (NF4 SLIX16) board, 2GB of Corsair TWINX2048-3200 (CAS 2) RAM, a Western Digital Raptor 74GB drive, a Plextor PX-716AL drive, and onboard sound and Ethernet. The system ran on Windows XP Pro SP2 with DirectX 9.0c (June distribution), ForceWare v91.33, and nForce chipset v6.85 drivers installed.

Considering that Nvidia's GeForce 7900 GTX has four more pixel-shader processors, a larger frame buffer (256MB vs. 512MB), and is clocked much higher than the older 7800 GT, we weren't expecting our modded card to catch its more powerful cousin in the benchmarks. It would have taken monumental clock speed increases to overcome those disadvantages. We did, however, expect huge performance gains from our tricked-out 7800 GT vs. its stock configuration. We weren't disappointed in the least. The card's voltage mod and enhanced cooling let us raise the GPU and memory clock frequencies by 110MHz and 115MHz, respectively, resulting in significant 20 to 40% performance improvements, depending on the benchmark. Not bad for a $23 investment. ▲

	GeForce 7800 GT; stock	GeForce 7800 GT; stock and overclocked	GeForce 7800 GT; modded and overclocked	GeForce 7900 GTX; stock
GPU/Memory	400MHz/1GHz	481MHz/1.112GHz	510MHz/1.115GHz	650MHz/1.6GHz
3DMark06; 1,280 x 1,024 (default test)	3776	4381	4486	6060
Half-Life 2; 1,600 x 1,200 (4XAA/16XAF)	90.53	117.68	126.18	138.84
Far Cry v1.33; 1,600 x 1,200 (4XAA/16XAF)	48.54	54.04	59.56	77.94
Quake 4 v1.2; SMP Enabled 1,600 x 1,200 (No AA/8XAF)	66.3	76.1	80.9	100.3
F.E.A.R. v1.06; 1,600 x 1,200 (4XAA/16XAF)	29	33	34	48



NiBiTor 2.9a

File: Internal BIOS
Device: Nvidia PCI-E 7800 GT
BIOS Version: 05.70.02.13.12
Vendor: XFX
Date: 07/15/05
Product: G70 Board - p317h2
Integrity: ●

Exact Mode: 3D: 1.5V; Thrtl: ; 2D: 1.2V; ☑ Extend Voltage Table

VID Mode:

	Voltage identifier	VID	Voltage for VID
Voltage 4:	1.5V	3	1.5V
Voltage 3:	1.4V	2	1.4V
Voltage 2:	1.3V	1	1.3V
Voltage 1:	1.2V	0	1.2V

Remember: 1. Always keep a clean backup of your old BIOS.
2. Have a PCI card at hand to flash if things go wrong.
3. Probably not every BIOS will be read correctly.

You do all modifications at your own risk!

Voltage Table Editor

Voltage table header:
Distance between entries: 05
Amount of active entries: 04
VID Bitmask: 03

Voltage table entries:

	Label	VID
Entry 1:	1.2V	00
Entry 2:	1.3V	01
Entry 3:	1.4V	02
Entry 4:	1.5V	03

Using NiBiTor in conjunction with nvFlash, we increased our GeForce 7800 GT card's core GPU voltage from 1.4 to 1.5V. The higher voltage, plus enhanced cooling, let us overclock our card well above its stock specifications.

the 1.5V option. By default, this option will be set at 1.4V for most GeForce 7800 GT cards. Now select the VID Mode tab. If it doesn't appear as shown in the photos in this article, go back to the Tools menu, select the Voltage Table Editor option, and edit the table as necessary.

Once you've made the necessary changes, go to NiBiTor's File menu and choose the option to save the modified BIOS to a file. We saved our BIOS using the file name mod_bios.rom. NiBiTor doesn't alter the card's BIOS directly, so you must save the modded BIOS to a file and flash it to the card manually. If you want to back up your original video card's BIOS, you can also save the unmodified version immediately after reading the BIOS into NiBiTor.

Parts List

We only needed to purchase one part for this project—that being the Arctic Cooling Accelero X1 ($22.99), which bundled thermal pads and paste in the package—as most of the necessary tools and utilities were available free online. Some users would argue that we didn't need to spend any money to complete this mod, but to obtain optimal results we thought it best to enhance the 7800 GT's cooling. Anytime you increase the voltage supplied to a component, the thermal output also increases. So, taking the cooling up a notch is a good idea. ▲

Now, copy the modified BIOS and the nvFlash utility and its supporting files to a bootable floppy and restart your system with the floppy in the drive. If you don't have a floppy drive, a bootable flash drive will work, as well. At the DOS prompt, type **nvflash –r** and press ENTER. Running nvFlash with the -r parameter removes the EEPROM write protection, which will let you flash the video BIOS.

After removing the EEPROM write protection, run nvFlash again with the following parameters: **nvflash -5 -6 -A -y mod_bios.rom** and press ENTER. The -5 and -6 parameters force the flash, even if there are firmware and ID mismatches. -A tells nvFlash to run automatically without user intervention. -y tells the program to reboot the system after a successful flash, and mod_bios.rom is the name we used when we saved the modified BIOS file with NiBiTor. If you use a different file name, substitute your file name for the one we used in this step.

After you've flashed the video BIOS, the system should reboot automatically. Remove the floppy from the drive and boot into Windows normally. Next, use the CoolBits Registry tweak to unlock the overclocking options lurking within Nvidia's ForceWare drivers and overclock the card.

Before our mods we could overclock our card's GPU and RAM to 481MHz and 1.112GHz (DDR), respectively. After the mods the same GeForce 7800 GT hit 510MHz and 1.115GHz. Not bad considering the card's default clock speeds are 400MHz and 1GHz.

A Mod Worth The Effort

Talk about a worthwhile mod. For less than $25 and about an hour's worth of work, we significantly increased the performance of our GeForce 7800 GT, making it run cooler and quieter in the process. (See the "Performance Profile: Tweaked, Overclocked & Ready To Rock" sidebar for our benchmark results.) If you can't afford to or just don't want to upgrade from a GeForce 7800 GT, this mod is a great way to bolster your gaming performance without making a big investment. ▲

by Marco Chiappetta

Bad Flash? No Problem

For instructions on how to recover from a failed video card BIOS flash, see the "The Sapphire Radeon X800 GTO2 Mod" article in *CPU's* April 2006 issue (page 40). ▲

The Choice of Champions

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- Enables NVIDIA SLI™ technology with two full-bandwidth PCI-E X16 slots
- Integrated Dual Gigabit Ethernet solution
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GA-M57SLI-S4

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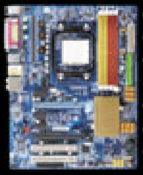

- AMD Athlon™ 64 X2/ Athlon™ 64 socket AM2 platform
- Supports Dual Channel DDRII800 memory architecture
- NVIDIA SLI Multi-GPU function for extreme graphics performance
- Integrated Gigabit Ethernet solution
- Integrated T.I. IEEE1394 FireWire interface
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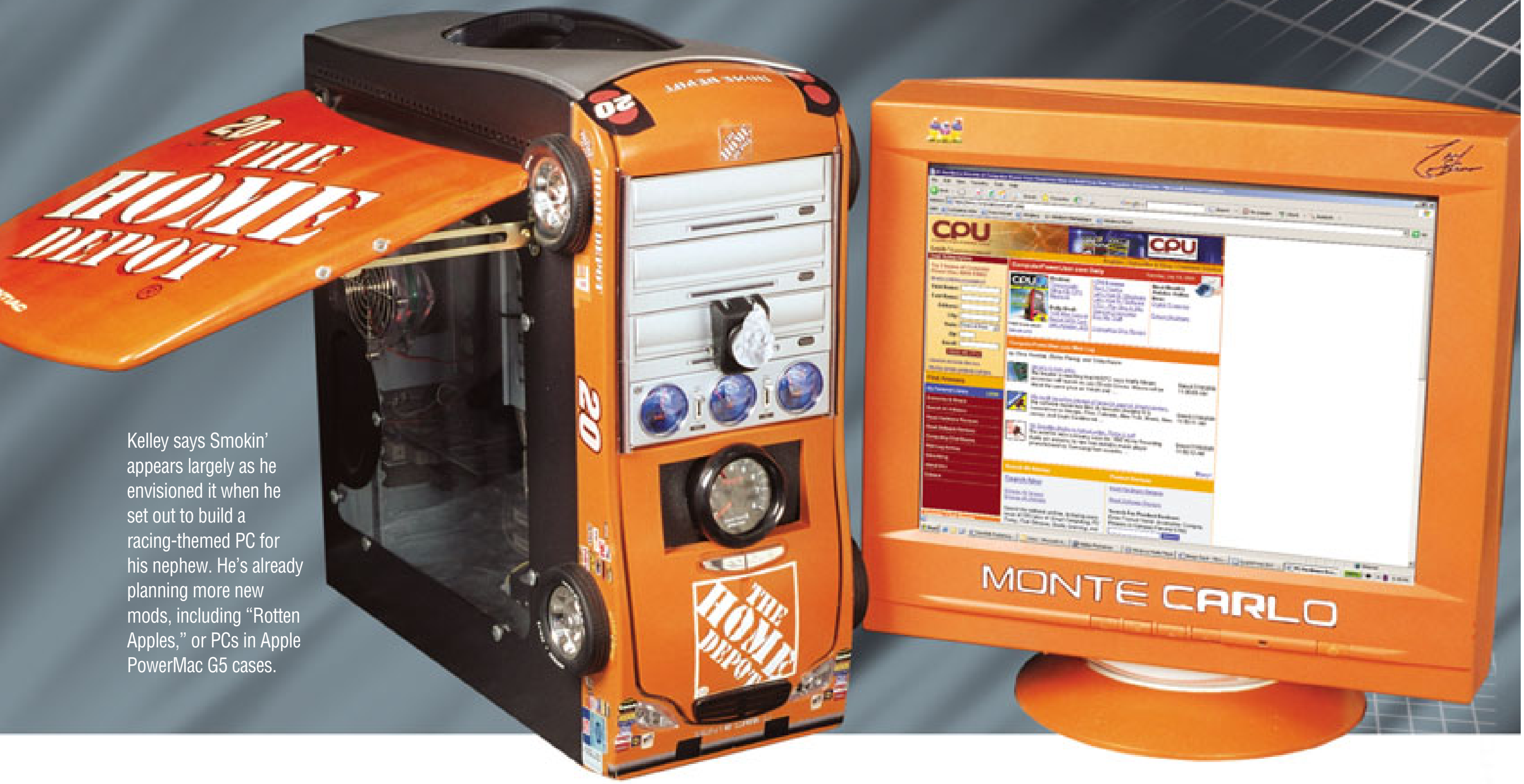
Mad Reader MOD

Smokin' Gets On Track



Kelley says Smokin' appears largely as he envisioned it when he set out to build a racing-themed PC for his nephew. He's already planning more new mods, including "Rotten Apples," or PCs in Apple PowerMac G5 cases.

How Keith Kelley managed to part with this tribute to NASCAR, we will never know. He built and modded this setup, which includes a full system and jaw-dropping driver's seat for his lucky nephew, a fan of Tony Stewart. The setup, named Smokin' (derived from Stewart's nickname), is Kelley's most hardcore mod, but not his first.

A Christmas family tradition, in which one member draws another family member's name and creates a gift by hand, introduced Kelley to the modding world a little at time, starting with a Rusty Wallace-themed computer. "I made it look the part, but I didn't redesign or take [anything] apart," says Kelley. "I just added on. From that point on, the mods have gotten more difficult because I had to top last year's."

The middle school librarian from Paris, Maine, sought out used and refurbished parts while shopping for Smokin's guts. He says even the driver's seat had a past life as a psychiatric hospital chair. This month's mad modder spruced the chair up with orange paint, black vinyl, and a Logitech MOMO Racing wheel, which includes pedals and provides force feedback.

Kelley's creativity didn't end with the chair. Rather than just cut a window on the side of the computer, he built a flap that swings upward to reveal the system's interior. The other side panel sports a portion of a helmet, complete with a photo of the driver's face. Of course it wouldn't be a racing PC without wheels, so Kelley converted the case's front panel into a bright-orange car, complete with toy car tires. Vroom. ▲

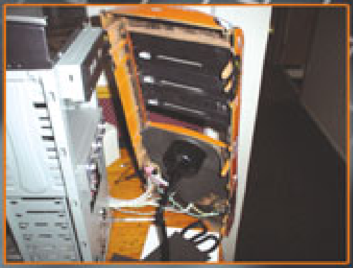
by Joshua Gulick

Give Us Your Mod ▶

Have a computer mod that will bring tears to our eyes? Email photos and a description to madreadermod@cpumag.com. We're looking for rigs that are recognizable as PCs; your Wookiee mod won't find a home here. If we include your system in our "Mad Reader Mod" section, we'll help you load up your modder's toolbox with $1,500 and a one-year subscription to *CPU*.

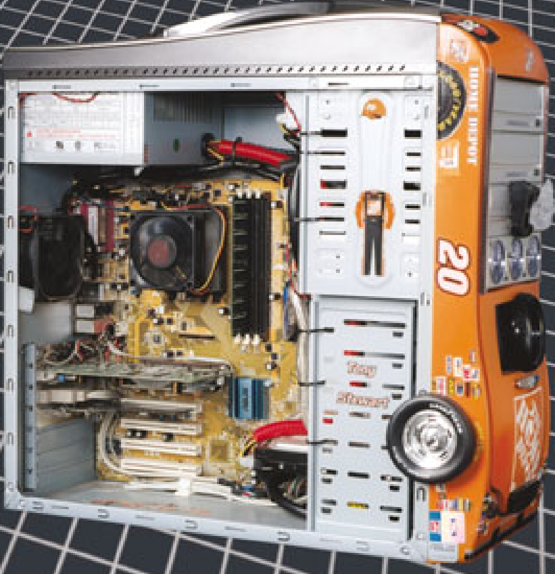
Only a modder could see the race car that wanted to break free from the Linkworld 3210-04-C2628 case's front panel. "I painted the whole front bezel white and then put on the main logo stencil [HOME DEPOT], which I made from using the Stencil font in Word," says Kelley. "I figured out the correct size and then took my model knife and cut it out."

Kelley's nephew is a Tony Stewart fan, so Kelly created stickers to mimic the race driver's car (and added a few PC-related stickers for fun). Kelley printed the logos on sticker paper.



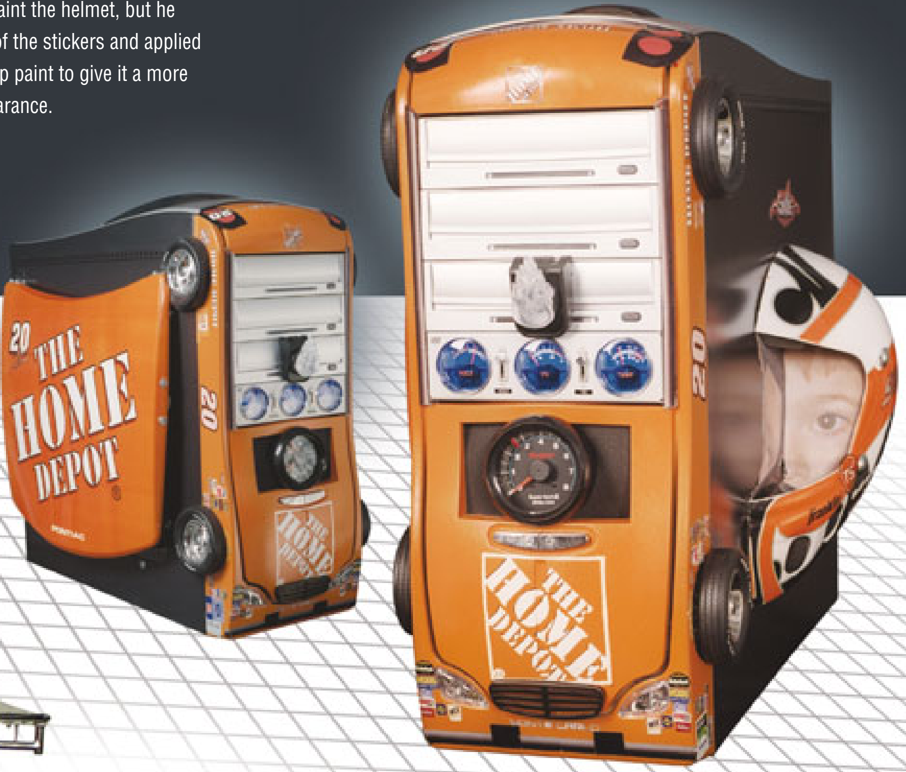
A tachometer blocks out a floppy drive, but it enhances the racing theme. The finished front panel also included a cigarette lighter that powered the smoke adapter.

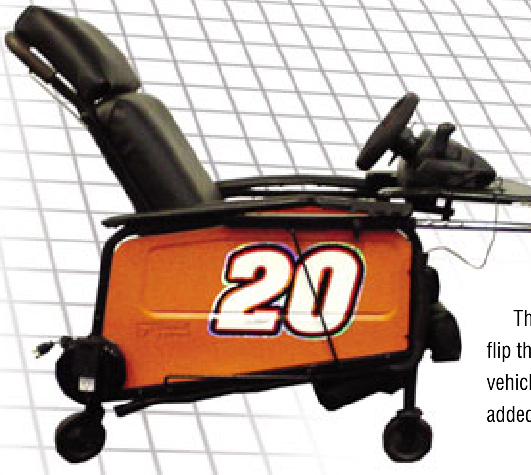
Kelley didn't paint the helmet, but he moved some of the stickers and applied a little touch-up paint to give it a more polished appearance.



Kelley used red and metallic tubes to keep much of the system's wires out of sight and to bring the vehicle theme into the case.

A picture of Kelly's nephew's face completes the helmet mod. Kelley has modded several computers for family members previously and leads the computer club at the middle school he works at.





The wheel mounts on a food tray so drivers can flip the wheel out of the way when they get into their vehicle. Kelley routed the cables along the chair and added a retractable power cable to reduce clutter.

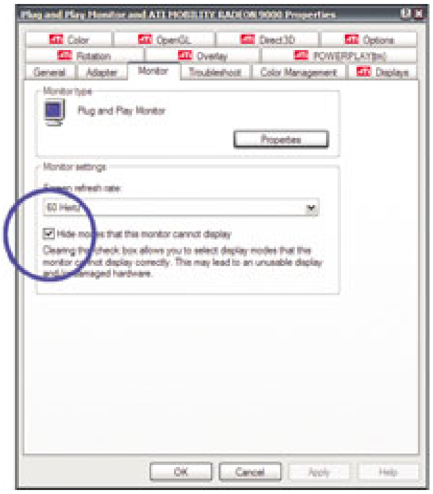
advanced Q&A corner

Get informed answers to your advanced technical questions from *CPU*. Send your questions along with a phone and/or fax number, so we can call you if necessary, to q&a@cpumag.com. Please include all pertinent system information.

> “Intel’s Core 2 Duo processor for the desktop could also make for an excellent HTPC setup with considerably better power and heat characteristics over legacy Pentium D chips.”

Each month we dig deep into the mailbag here at CPU *in an effort to answer your most pressing technical questions. Want some advice on your next purchase or upgrade? Have a ghost in your machine? Are BSODs making your life miserable?* CPU*’s “Advanced Q&A Corner” is here for you.*

Frank C. asked: A few weeks ago I won an auction on eBay for a 21-inch IBM P260 CRT monitor that’s now giving me trouble. As much as I would’ve liked to have bought a brand-new LCD, I just didn’t have the funds at the time. I’m a student paying my own way through school and can hardly afford dinner, let alone an expensive CRT. The problem with this monitor is that it didn’t arrive with any drivers or manuals, and I can’t set my resolution the way I want. The monitor is supposed to be capable of running at 1,920 x 1,440 at 75Hz, but I can’t get it to go higher than 1,600 x 1,200. My graphics adapter says it’s capable of 2,048 x 1,536, my video drivers are up-to-date, and I’ve completely updated my Windows installation. What gives here? Do you think this monitor is defective?



Screen refresh rate: 60 Hertz

☑ Hide modes that this monitor cannot display

Clearing this check box allows you to select display modes that this monitor cannot display correctly. This may lead to an unusable display and/or damaged hardware.

You can manually unlock hidden resolution and refresh rate options through the display properties Control Panel.

A: Your monitor is probably working fine, Frank. Several things could be causing the problem you’re having. We suspect Windows didn’t detect the monitor properly when you first connected it to your machine. To redetect your new monitor, click Start, Settings, Control Panel, and double-click System. In the System Properties window, click the Hardware tab and then click the Device Manager button. In the Device Manager window, locate the Monitors entry, click the plus sign (+), and uninstall any of the monitors in the list. Restart your computer and let Windows redetect your new monitor. If Windows is still using the settings stored from your previous monitor, uninstalling the older driver and letting Windows redetect the new monitor could solve the problem.

If that doesn't work, you can search Google for "IBM P260 Monitor INF" and find several sites that have the appropriate driver available for download. (*NOTE: Some of the sites require free registration to gain access to the file.*) After downloading the file, try installing the correct driver and see what happens.

As a last resort, you could unlock all of the resolutions your graphics card supports, regardless of what monitor is connected to your system, through the Windows Control Panel. Go into the Control Panel and this time double-click Display. In the Display Properties window, click the Settings tab and then the Advanced button. In the next window, click the Monitor tab and uncheck the Hide Modes That This Monitor Cannot Display checkbox. Click Apply and then OK. You should now be able to select whatever resolution and refresh rate you want. But be careful because selecting a resolution or refresh rate that your monitor doesn't support could cause irreparable damage.

Heather T. asked: **I've been keeping up on Intel's Core Duo architecture ever since it was introduced for notebooks awhile back. Although Intel has fallen behind a bit in desktop processor performance, it's always held strong with its mobile chips. I've been very happy with the Pentium M that's in my Dell notebook, and I hear Core Duo chips are going to be even faster clock for clock. Are these new Core Duo chips just two Pentium Ms under one roof? Also, I've been thinking about possibly building a HTPC. I think I read somewhere that there are a few motherboard manufacturers that have released desktop boards that will run a Core Duo mobile chip. Is this fact or fiction?**

A: It's true that Intel's mobile CPU design team has been firing on all cylinders for a long time now, and Intel's notebook platform is very strong. Legacy Pentium M Dothan-core CPUs actually offer about the same performance in many applications as their desktop Pentium 4 counterparts, even at clock speeds that are 1GHz slower. It just goes to show you that the "megahertz myth" was dispelled long ago. Where the Pentium M lacked punch compared to the Pentium 4 was with multitasking and multithreaded applications. The Pentium M could only run single-threaded applications, but the Pentium 4's Hyper-Threading technology lets it run multithreaded applications and provides better multitasking performance. Of course, all of this has changed once again with the age of the dual-core CPU and Intel's new Core CPU architecture.

The new Intel Core Duo processor line for notebooks is not, however, just two Pentium Ms under one hood. In fact, Intel has significantly enhanced and revamped its Yonah core for its Core Duo mobile CPU family in many areas. Each CPU core on this chip shares a single, large 2MB L2 cache and these cores are integrated into a single, monolithic die. In addition, Intel has also beefed up the processor's FP (floating point) and SSE instruction processing capabilities with what the company calls Digital Media Boost technology. In short, Core Duo is more than just doubly as good as a single Pentium M. For multimedia applications, such as those found in a HTPC setup, the new Core Duo should excel. It will make an excellent foundation to build an HTPC.

Motherboard manufacturers such as Asus and AOpen have launched products based on Intel's 945 GM mobile chipset but in SFF mini-ATX motherboard designs. With either Intel's integrated video capabilities in the chipset or via a PCI Express slot, these motherboards scream family fun. (You'll need to drop in a dedicated graphics card for high-def TV output or any sort of serious gaming.)

We've caught wind that Intel's upcoming Merom Core Duo processor for notebooks will also drop into the same socket 479 and chipset architecture, so theoretically you could even have a decent upgrade path with one of these motherboards, as well. As an alternative, Intel's Core 2 Duo processor for the desktop could also make for an excellent HTPC setup with considerably better power and heat characteristics over legacy Pentium D chips.

Kelly asked: **I was hoping you could help me. I'm interested in watercooling my entire system—that being the CPU, graphics card, and northbridge (no fans at all except for the radiator). I'm building a new rig piece by piece and getting each component as I can find them on sale. So, while I'm looking for a good, quality pump and waterblocks, I'm also looking for a good price.**

Another issue is as to whether my PSU will be up to the task of powering this would-be monster (lots of overclocking), and if not, what do you recommend?

This is what I have so far: Seasonic 500W PSU, Radeon X1800 XT, 74GB Raptor, and two optical drives.

This is what I will be getting: Opteron 270, 2GB PC28500 DDR2 (not sure which brand yet), Sound Blaster X-Fi, Asus motherboard (not sure which one yet), and a 500GB HD. Any suggestions would be greatly appreciated.

A: You're contending with a lot of issues here, Kelly. To answer your specific question, your Seasonic PSU will probably be fine considering you only plan to use a single graphics card and a single hard drive and will be eliminating your GPU and CPU cooling fans. However, your processor/RAM choice and intention not to have fans in the system other than the radiator fan present some problems.

If you plan to purchase DDR2 RAM, you'll have to go with a Socket AM2 processor (assuming you're going to stick with AMD), and as of today, there are no AM2 Opterons available. Although, a low-to-midrange Athlon 64 X2 processor will be just as powerful and will satiate your desire to overclock, so this isn't a huge deal. On the flipside, you could always go with standard DDR RAM and stick with the Opteron and a Socket 939 motherboard, but we think it's a better idea to migrate to the updated AM2 platform. Asus' M2N32-SLI Deluxe motherboard would be a fine choice.

Now let's talk about your watercooling plans. Watercooling is a good way to keep components cool, but you have to think about the rest of your system, too. Your processor, GPU, and northbridge will likely be the hottest parts of the system, but the motherboard's VRM, your RAM, hard drive, and expansion cards need to be cooled, as well. Typically, the VRM is "cooled" by the air circulated by the processor's heatsink/fan combo. And intake and exhaust fans mounted in a case cool expansion cards and hard drives. If you eliminate the CPU fan and your case fans, most of the air in the system will remain stagnant and the components in your rig that aren't watercooled will get increasingly warm during periods of prolonged use and are likely to overheat. Sure, your PSU's fans will circulate some air in the system, but it won't be enough to ensure long-term stability. A good watercooled system strikes a balance between water and air cooling. To ensure your rig is stable, install some quiet intake and exhaust fans in your case as well. It will require a minimal investment, they won't generate all that much noise (if any), and your system will be far more reliable.

FlipChip asked: **I'm an avid PC gamer. I live for first person shooters and strategy games such as Battlefield 2, Counter-Strike: Source, Quake 4, and I've even taken an interest in role-playing games such as Oblivion. All of these games, to some degree or another, place a heavy toll on my graphics card (GeForce 7800 GTX), and because I game at high resolutions such as 1,600 x 1,200, the load is even heavier. One of these days I might upgrade to a 24-inch widescreen panel, but right now I want more power. I was thinking about going with SLI until I heard about Quad SLI. Can I really run four GPUs in my system at once? Oh the nirvana. . . .**

A: Yes and no; well, mostly yes, but Nvidia was still stabilizing things for Quad SLI as of this writing. Nvidia has been hard at work getting this technology stable enough for the mainstream DIYer market. Quad SLI is, in its current incarnation anyway, a pair of dual GPU GeForce 7 series cards configured for SLI between them. There are two flavors of these cards available today: the GeForce 7900 GX2 and the GeForce 7950 GX2, the latter of which Nvidia has released to retail and is widely available. The GeForce 7900 GX2 was only made available to select OEMs and system builders. Regardless, the GeForce 7950 GX2 is a more refined version of the card with a much smaller PCB. What this card does is connect two GeForce 7900 GPUs, each with its own 512MB of RAM, together on one card via a PCI-E switch, which then aggregates them into a single x16 PCI Express slot. You can pair two of these double-stacked cards (they literally look like two 7900 GT cards stuck together) together in two x16 PEG slots, along with Nvidia's standard PCI-E link connector PCB. In addition, Nvidia's current Rel. 90 drivers support Quad SLI—or do they? Ay, there's the rub.

At the time we received this question from you, Nvidia didn't "officially" support Quad SLI in the retail DIY market. Granted its drivers support Quad SLI for a few game titles currently, such as Quake 4 and Battlefield 2, but interoperability testing with several motherboards is ongoing (in addition to driver-level support for a broader list of game engines). You could actually purchase a pair of GeForce 7950 GX2 cards today and configure them together in SLI for Quad SLI graphics (depending on motherboard compatibility), but you may not get a performance boost that would scale up to four times the performance accordingly. Even if you have money burning a hole in your pocket (a pair of these cards will set you back approximately $1,200), we'd recommend holding off for Quad SLI until it matures a bit more. Not to mention the fact that running two of these cards at any resolution lower than 1,920 x 1,200 is wasting GPU horsepower. In the meantime, if you're on the fast track to upgrade your panel to the 1,920 x 1,200 resolution that a 24-inch wide screen LCD supports, why not go with a single GeForce 7950 GX2 for now? All by itself this card can handle just about anything you can throw at it, even at 1,920 x 1,200 res. ▲

by Dave Altavilla and Marco Chiappetta,
the experts over at HotHardware.com

Nvidia's GeForce 7950 GX2 packs a ton of muscle with its dual GeForce 7900 512MB design, which plugs into a single x16 PEG slot.

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that can be installed in slim as well as LP cases.
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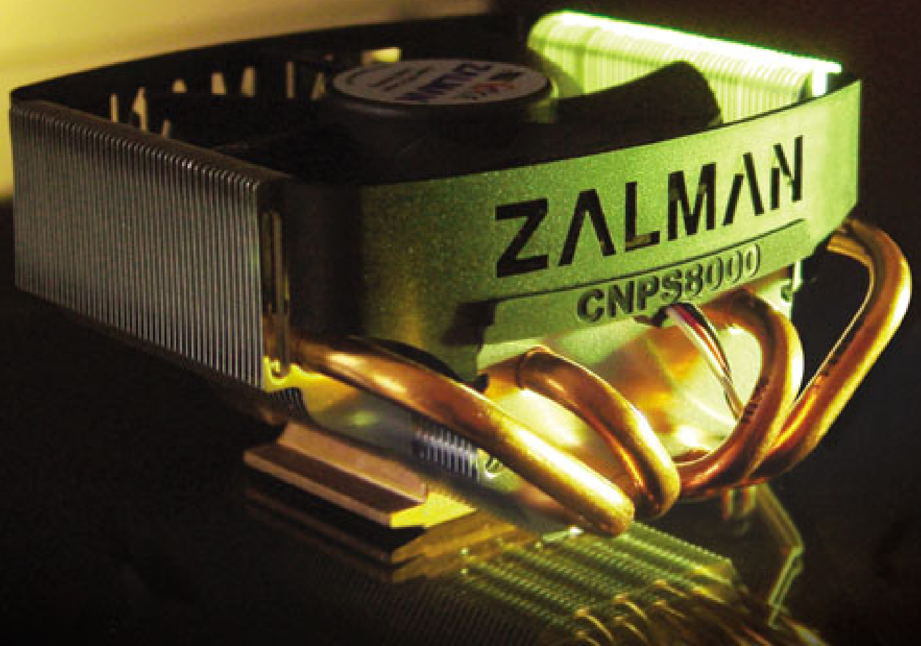

* Intel Pentium D(Socket 775)/Pentium 4(Socket775), AMD AMD64(Socket754/939/940) 지원.

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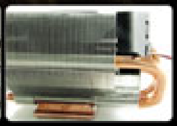
62mm Slim Design

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Nanocrystal Displays

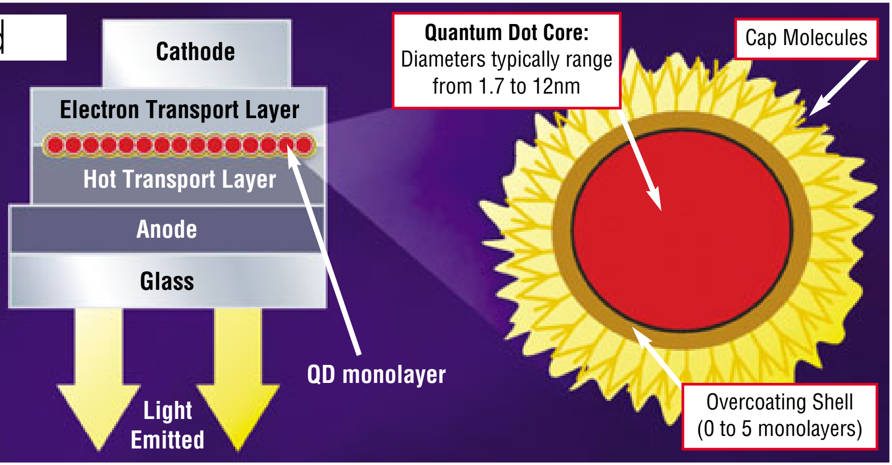
Next Big, Big Thing In Display Technology

The "next big thing" in display technology during the past few years has been OLEDs (organic light-emitting diodes). Serious discussions about the future of OLED displays began in the early part of this decade. Although research continues and hopes remain high, OLEDs still haven't reached the mainstream market.

While users wait for OLEDs, researchers may already be developing the next big, big thing in display technology. QD Vision announced this past summer

QD-LED Examined

The configuration of the individual components in the QD-LED display is similar to some OLED configurations. The layer of QDs (quantum dots) fits between two transport layers. As voltage is applied to the anode and cathode, electrons move from the hole transport layer to the electron transport layer. As the electrons move out of the QDs, they emit light through the transparent anode and the glass. ▲



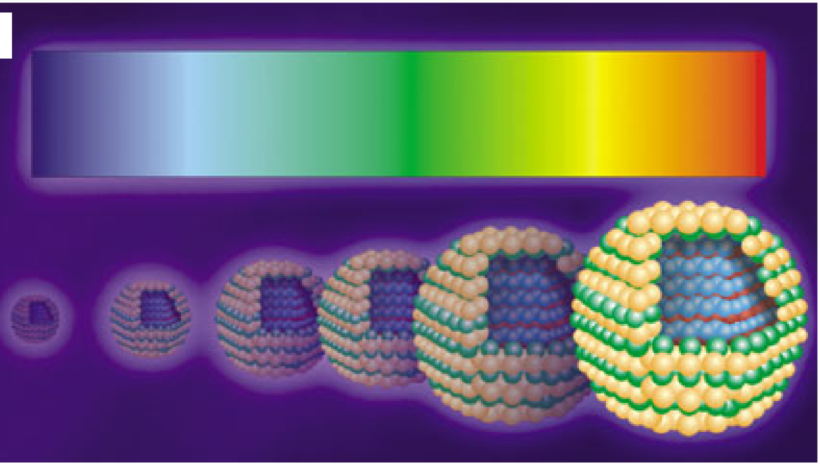
Sources: QD Vision, Society for Information Display, Evident Technologies

Quantum Dot Colors

Because the QD-LED system confines the QDs, they release a specific amount of energy that researchers can calculate using quantum mechanics.

Researchers can control the color of QDs that make up a display by altering their size. The larger the diameter of a QD, the less energy it releases; the smaller the diameter, the more energy the QD releases. This results in light emissions of specific colors.

Quantum dots with larger diameters yield red light (far right of the spectrum); as the diameter decreases, the quantum dot yields light that shifts from green to blue. ▲



Sources: QD Vision, Society for Information Display, Evident Technologies

Quantum Dot Global Market

BCC Research has projected explosive growth for the QD market worldwide as new uses for the technology become available. ▲

2003	2005	2007	2009
Total: $5 million (all biology and medical sectors)	**Total:** $13 million (all biology and medical sectors)	**Total:** $279.5 million ($122 million biology and medical sectors) **Memory sector:** $157.5 million	**Total:** $522.5 million ($193.2 million biology and medical sectors) **Display sector:** $18.8 million **Memory sector:** $190.5 million **Solar energy sector:** $120 million

Source: BCC Research

that it has developed a small, test display screen that uses nanocrystals (also called QDs [quantum dots]).

The nanocrystal test display from QD Vision (called QD-LED) contains about 2,000 monochrome pixels. In the future nanocrystal displays will be flexible and brighter than any displays currently available. However, as the technology evolves, it probably won't be until later this decade or early next decade before nanocrystal displays would have a chance to be a significant force in the display market. ▲

by Kyle Schurman

Quantum Dot Research

A QD (quantum dot) is also called a semiconductor nanocrystal or an "artificial atom" because they have an energy level similar to an atom. These energy levels yield the color you can see in a nanocrystal display.

Research into QDs/nanocrystals began in 1960, according to the Quantum Dot History Project from Evident Technologies, and it has grown substantially during the past 25 years. Researchers at Sandia National Labs, MIT, and the U.S. Department of Energy have made several breakthroughs using QDs in lighting in the past several years.

More recently, a discovery at Vanderbilt University has combined LEDs and QDs to create a more pure white light. LED lights usually have a bluish tinge, but they became whiter and warmer when researchers combined them with QDs. And just last year Nanosys received two patents related to using nanocrystals in displays.

Research into QDs goes far beyond lighting and displays, though, including blue lasers for HD-DVD and Blu-ray, quantum computation, development of memory, biological research, and some medical applications. ▲

Fast Facts:

A quantum dot usually fits into these ranges

- 2 to 10nm in diameter (or 10 to 50 atoms in diameter)
- Contains 100 to 1,000 electrons

Source: Wikipedia

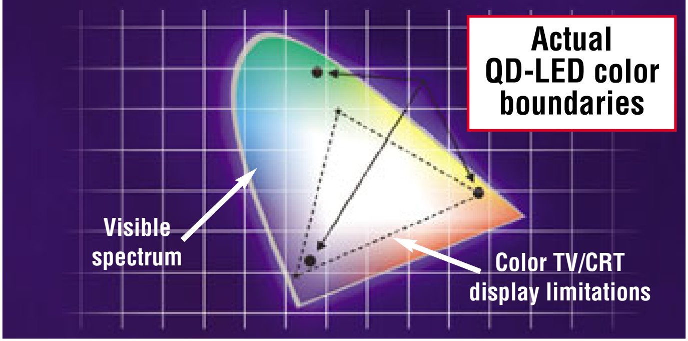
QD-LED: Three Improvements Over Current Display Technology

According to QD Vision researchers, QD-LED displays should eventually offer three key benefits over current high-end display technologies, including a larger color range, more vibrant colors, and less power usage.

Color range. Nanocrystal displays should be able to yield a greater portion of the visible spectrum than current technologies. As shown in the diagram, QD Vision calculates as much as 30% more of the visible spectrum would be available using QDs in a QD-LED vs. a CRT TV.

Low power consumption. QD Vision estimates its nanocrystal displays could use 3 to 5% less electrical power than an LCD, in large part because nanocrystal displays don't need a backlight.

Vibrant colors. Nanocrystal displays would yield more purity in colors than other types of display technologies. Some display technologies, such as LCDs, can't create a pure red, green, or blue for the display; instead, they need to add a few other colors to those three to display pure colors. Quantum dots, on the other hand, create pure red, green, and blue to create all other colors. ▲


Actual QD-LED color boundaries
Visible spectrum
Color TV/CRT display limitations

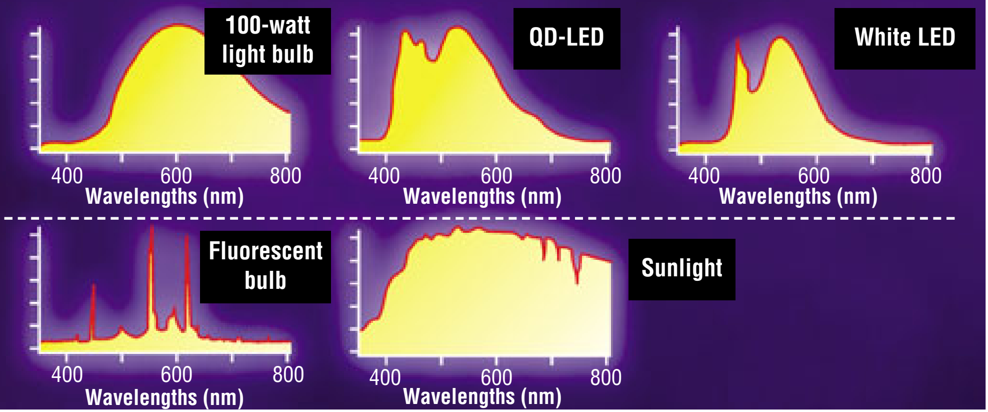
Sources: QD Vision, Society for Information Display

Emissions From Various Light Sources

As the graphs show, QD-LED's visible emissions spectrum is closer to sunlight than other light sources.

As an added benefit, QD-LED would provide its strong visible light emission by using less power than the other options shown here. For example, some of the energy the 100W light bulb uses is lost through heat generation, as shown by the infrared emissions near and beyond the 800nm wavelength range in its graph.

Most humans can see visible light ranging from 400 to 700nm wavelengths, although some people have the ability to view light in wavelengths ranging from 380 to 780nm. (Beyond 700 to 780nm wavelengths is infrared.) ▲



Sources: Vanderbilt University, Wikipedia

RuBee

Adding Flexibility To The RFID Market

First things, first: Despite what you may have heard about a relatively new technology called RuBee, RFID isn't going anywhere right now. However, RFID needs to move over and make room for RuBee because this new technology should fill in some of the gaps in the market that RFID can't meet.

RuBee and RFID both are product-tracking technologies. Although the technologies behind them differ, they both make use of a tiny antenna embedded in products or packaging that uniquely identifies a product. Reader hardware can automatically track each

RuBee vs. RFID

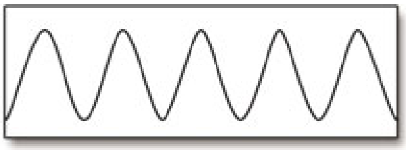
RuBee operates at a LF (low frequency), always below the 450KHz range and often in the 132KHz range. These LF waves use inductive energy and act more magnetic than radio. Visible Assets' John Stevens says RuBee tags create waves that work like 99.9% magnetic waves and 0.1% radio waves.

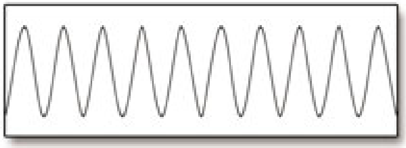
RFID operates at a high frequency, in the 13.56MHz range for HF (high frequency) RFID, and in the 916MHz for UHF (ultra high frequency) RFID.

Radio waves lose their ability to travel over distances when they encounter water and metal, which limits RFID's effectiveness in some circumstances. Liquid will absorb the radio waves, while metal can detune the RFID antenna and the reader antenna. The radio waves also bounce off metal under some circumstances, causing interference.

Water and metal don't affect magnetic waves as strongly, though, meaning that RuBee works in some areas where RFID cannot. RuBee's supporters call this working in a "harsh environment." For example, shoplifters try to beat an RFID tracking tag in a product by wrapping the product in foil. Such methods wouldn't work if the product had a RuBee tag.

RuBee tags, with their low frequencies, have a far smaller bandwidth for data transfer than do RFID tags, meaning RuBee readers can't work as quickly as RFID readers. (About 6 to 10 reads per second for RuBee tags vs. 100 to 600 or more reads per second for RFID tags.) However, most RuBee customers won't be looking for speed, according to Visible Assets; instead, they will typically want to track the location of assets rather than counting large numbers of items as they move from location to location on a conveyor belt. ▲


Low frequency, longer wavelength.

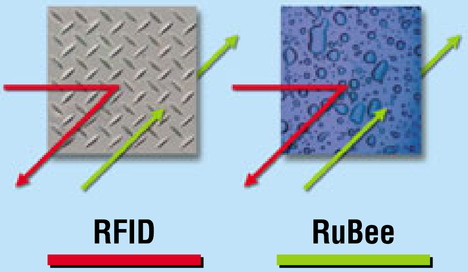

High frequency, shorter wavelength.

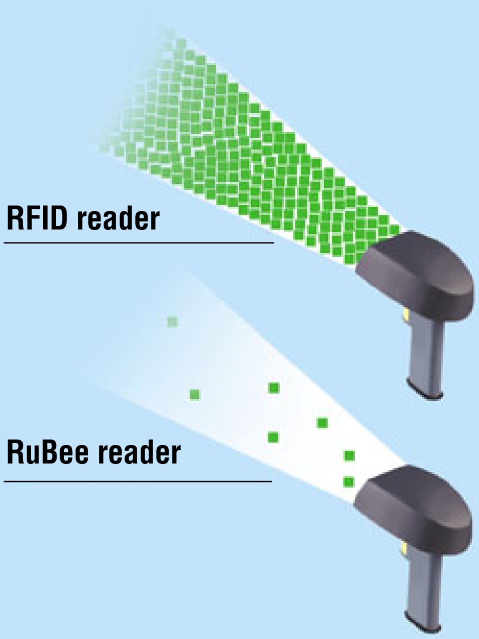
Calculating Frequencies

We read radio waves as a frequency, which is the number of waves that pass a point in space per second. We measure frequencies in Hz (Hertz). A RuBee wave's frequency is about 132KHz, or 132,000 waves per second. RFID uses megahertz to measure its frequencies, which total about 13.56MHz.

Low-frequency radio waves use longer wavelengths than high-frequency radio waves. (You measure one wavelength from one peak to an adjacent peak along the wave.)

The frequencies of the electromagnetic spectrum that are considered part of the radio spectrum are wide-ranging, from 3Hz to 300GHz.





Sources: Visible Assets, IEEE, RFID Journal, Wikipedia product. RFID has been around for a few years, but news and information about RuBee began appearing in earnest this summer. The less established RuBee should become a mainstream option in the second half of 2007 after researchers develop an IEEE standard (currently called P1902.1) for the RuBee protocol. Until then, you can expect manufacturers and other businesses to closely study the possibilities that RuBee will offer.

RFID At Work

Wal-Mart probably has been the most publicized large company that's employing RFID technology—the retail giant expects 300 of its suppliers to be RFID compliant by the end of 2006—but it certainly isn't the only arena in which RFID is in use.

Department of Defense. The Department of Defense uses RFID in Iraq, letting it better track equipment and fill requests from the field for critical components. The Defense department estimates that it's been able to improve its fill rates for orders of critical components from 77 to 89%, thanks to RFID technology.

Procter & Gamble. The company used RFID this past spring to track a Gillette razor in the retail market. Procter & Gamble tracked the razors from their factories to the retail outlets. The company then tracked how the outlets incorporated in-store advertising and promotions by how they moved razors to the floor. The study gave Procter & Gamble valuable insight into how retail stores handle their inventory.

World Cup. During the World Cup soccer tournament this summer officials embedded RFID tags into tickets for each event. These tags prevented counterfeiting of tickets. The tags with their automatic scanning of tickets were designed to move people through admission lines much more quickly than traditional ticket-taking methods. And by including the names of the ticket holders within the RFID chip, World Cup officials were able to prevent fans banned from the stadium from entering the games. ▲

A RuBee RFID Matchup

RuBee's creators at Visible Assets (www.visible-assets.com) say that RuBee isn't going to replace RFID, but the two technologies will have their individual places in the market. RuBee's backers say RFID technology doesn't fit every situation, and RuBee will be ready to move into the gaps. (See the "RuBee vs. RFID" sidebar for more information comparing the two technologies.)

When *CPU* detailed RFID technology two years ago, the promise of and momentum for RFID was extremely high. But, as RFID has appeared in more real-world situations, some problems have appeared. RFID's radio waves, which carry data wirelessly, work poorly in areas with a lot of liquid or metal (including metal shelving). And read rate accuracy hasn't always been as high as companies need or want, which has made it sometimes difficult to justify additional investments. Environments containing a large amount of metal or liquid don't hinder RuBee technology, giving it a significant advantage in certain circumstances over RFID.

Cost per tag is an area where RuBee and RFID almost certainly will exhibit some additional differences. Proponents of RFID often discuss a price point at which RFID's tag cost will be financially advantageous for many companies to use; usually estimated at less than 5 cents

IEEE P1902.1 Standard

John Stevens of Visible Assets is serving as the chairman for the P1902.1 Working Group as it develops the IEEE standard. The P1902.1 standard aims to bridge the gap between non-networked RFID standards and high-bandwidth wireless networking standards, such as 802.11.

The P1902.1 standard will provide a protocol that allows for the real-time searching of tags using IPv4 addresses. As part of the standard, an Ethernet-enabled router will manage the RuBee Visibility Network, which lets users view each RuBee tag and its corresponding data over the Web. Users can use special monitoring software to view the data, or, when they properly configure the tags and the visibility network, they can view the data on almost any search engine.

By creating a standard, it will be easier for more industries and individuals around the world to use RuBee. The standard will let many different companies create workable hardware, as well, which should help fuel growth of the use of RuBee. Epson's David Lamar says the development of the standard will be greatly advantageous for RuBee, but RuBee will succeed with or without the standard in place. "There are quite a few people already supporting it," Lamar says. "We were a partner before the standard was announced. We feel it's a proven technology already. We could see a large market with or without the standards committee."

The RuBee standard—officially called the IEEE Standard For Long Wavelength Wireless Network Protocol—will use a real-time, searchable protocol. The RuBee network will involve peer-to-peer networking, and, in some cases, a RuBee tag could serve as a reader, too. The RuBee tags will be around the same thickness as a credit card and can contain 4-bit processors, making them programmable. They also conserve power, allowing for a battery life of 10 years or more. ▲

Quick Facts For P1902.1

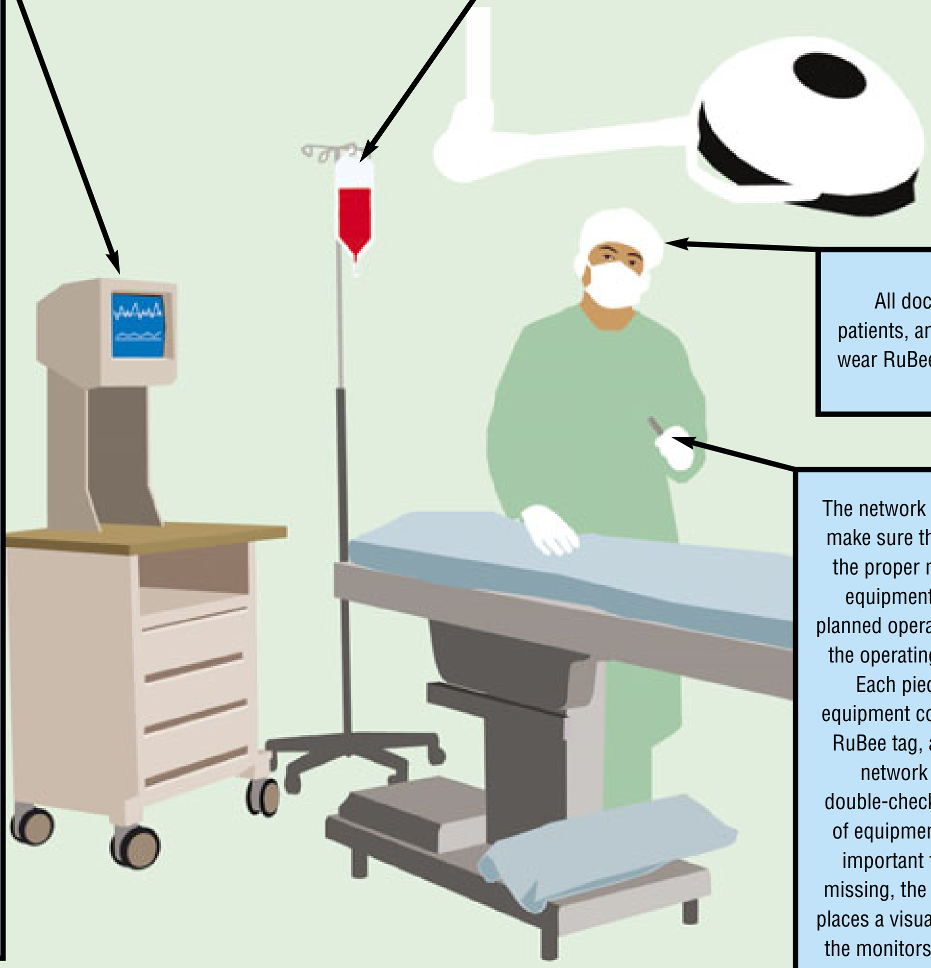
- Long wavelength
- Low frequency
- Low bandwidth (300 to 9,600 baud)
- Low power (10- to 15-year battery life)
- TCP/IP-like, peer-to-peer network protocol
- Medium range (50 by 50 feet)
- Works in harsh environments (large presence of metal and/or liquid)

per tag. RuBee's proponents, however, say that its cost per tag isn't overly important for their technology because workers can use RuBee to catch and prevent costly errors.

John Stevens, chairman and founder of Visible Assets, points to an example where a worker might inadvertently leave a small tool inside an engine after working on it. If the missing tool isn't discovered in time, the engine could fail. But, with a RuBee tag on the tool, the RuBee visibility system alerts the worker to his mistake before it causes an expensive accident.

Avoid Mistakes In The Operating Room With RuBee

All hospitals use some form of a tracking system for patients, drugs, and equipment that usually uses barcodes, manual tracking, or RFID (or a combination of all three methods). However, in many instances, a visibility system that uses RuBee (as shown here) might be a better choice than a tracking system.



Medications, plasma, and blood contain RuBee tags, too. Such tags not only pinpoint locations, but they also monitor temperatures and expiration dates for sensitive materials.

As a patient enters the operating room, the RuBee reader automatically makes a log of the entry in the network. The patient's RuBee tag identifies the patient himself and contains information about the patient's blood type, allergies to medication, and any other critical data.

As the network reads the RuBee tags and compiles the data, it notes any alerts or potential problems. For example, if the room contains a type of medication to which the patient is allergic, a warning message would appear on the monitors in the room.

Administrators also can configure the RuBee network to use matching alarms. If two items in conflict are both in the room, this would trigger an alarm.

All doctors, patients, and nurses wear RuBee ID tags.

The network also can make sure that all of the proper medical equipment for a planned operation is in the operating room. Each piece of equipment contains a RuBee tag, and the network can double-check the list of equipment. If an important tool is missing, the network places a visual alert on the monitors. Or, if a piece of equipment disappears during an operation, RuBee alerts the doctors.

In an operating room, this system conducts three key tasks:

1. **Exception and error processing.** If anything about the patient's data doesn't match the equipment, personnel, or medication in the OR, the system generates a warning message.
2. **Situation awareness**. Most large hospitals have multiple ORs and emergency rooms. Using RuBee tags and the proper software, it's easy to pinpoint the location of a particular doctor or piece of equipment that may be needed to deal with an emergency situation.
3. **Records archive.** The system automatically creates a timeline of events as they occur in the OR, such as when the patient and surgeon enter the room, when any medications are used, and when an operation ends. ▲

Sources: Visible Assets, IEEE

Tracking vs. Visibility

Although some media reports may say RuBee is challenging RFID in the "tracking" market, it isn't fair to lump RuBee as part of the tracking market. Stevens says RuBee works more as a "visibility" system, providing far more information than the simple tracking of objects or products through an assembly line.

A tracking system collects data to tell the user where an object has been, and it requires some human interaction to yield useful data. Tracking works well for counting inventory and making sure the inventory is moving as planned.

A visibility system, meanwhile, provides a real-time collection of information on the status of people and objects. A visibility system creates an audit trail and offers automated data aimed at error prevention.

"RuBee is not as good at tracking [as RFID]," Stevens says. "We can't read 200 items per second. But when the item goes to a shelf, RuBee [might be configured to take] a reading of the shelf every 10 minutes. If you have an inventory problem, you can tell where the inefficiencies are. It comes right out of that data. We're still learning about visibility. We've learned so much about it in a short amount of time." Stevens says he sees RuBee and its visibility system working well in industries and markets that have high-value assets, such as the health care industry.

Gaining Momentum

Soon after its announcements about RuBee this summer, Visible Assets received another boost when Epson Electronics America announced that it's serving as Visible Assets' silicon partner on RuBee. "We've looked at other RFID technologies, and we decided to go with RuBee," says David Lamar, general manager of the Epson Electronics America IC business unit. "We saw a lot of potential."

Stevens says he's heard the talk from some analysts that RuBee may be the technology that "saves face" for companies that have heavily invested in RFID with limited success. But he's not buying it, saying the media is overhyping the situation. RFID, in the right circumstances, works extremely well, he says. And RuBee will work well in other circumstances.

"I have a Gen2 UHF RFID system, and it's a very impressive piece of technology," Stevens says. "It's amazing how far the technology has come from Gen0 to Gen1 to Gen2. RuBee is amazing stuff [too]. It works very well. It's very robust. It's going to have a strong place in the market." ▲

by Kyle Schurman

Solving RFID's Metal Problems?

Two new RFID products are making strides at overcoming the technology's problems with harsh environments containing metal and liquid.

Adasa (www.adasainc.com) unveiled a new RFID Gen2 product this summer called FAT (foam attached tag) tag. The FAT tag is thicker than most RFID tags (about 5mm, or 0.2 inches) because of foam padding the company adds to the tag. The foam separates the tag from the metal, which lowers the negative effects of metal and liquid on the radio waves RFID technology uses.

Adasa's FAT tag is different from other foam-based RFID solutions, which require the user to take several steps to attach the foam. Adasa's FAT tags are ready to use immediately and the company can customize them for the user.

Secondly, SAVR Communications has developed an RFID reader, called Under Conveyor RFID Reader, that's designed to work with conveyor belts with metal rollers. (With other types of RFID readers, companies often must switch to plastic rollers in their conveyor belts.) The reader works at 13.56MHz frequencies and SAVR can optimize the reader, depending on the environment. ▲

Track Livestock

Using an RFID tag in the ear of cattle allows for the gathering of tracking data, including location of the cattle as they move. A user also could configure these tags also to include detailed information about each animal's pedigree and age, but adding such information after the fact is costly.

Because RuBee tags naturally contain data, any reader automatically accesses key information about each animal, such as pedigree and age. A user could also configure the RuBee tags to be tamper proof. The user can compile a database of readings taken throughout the animal's life, as well.

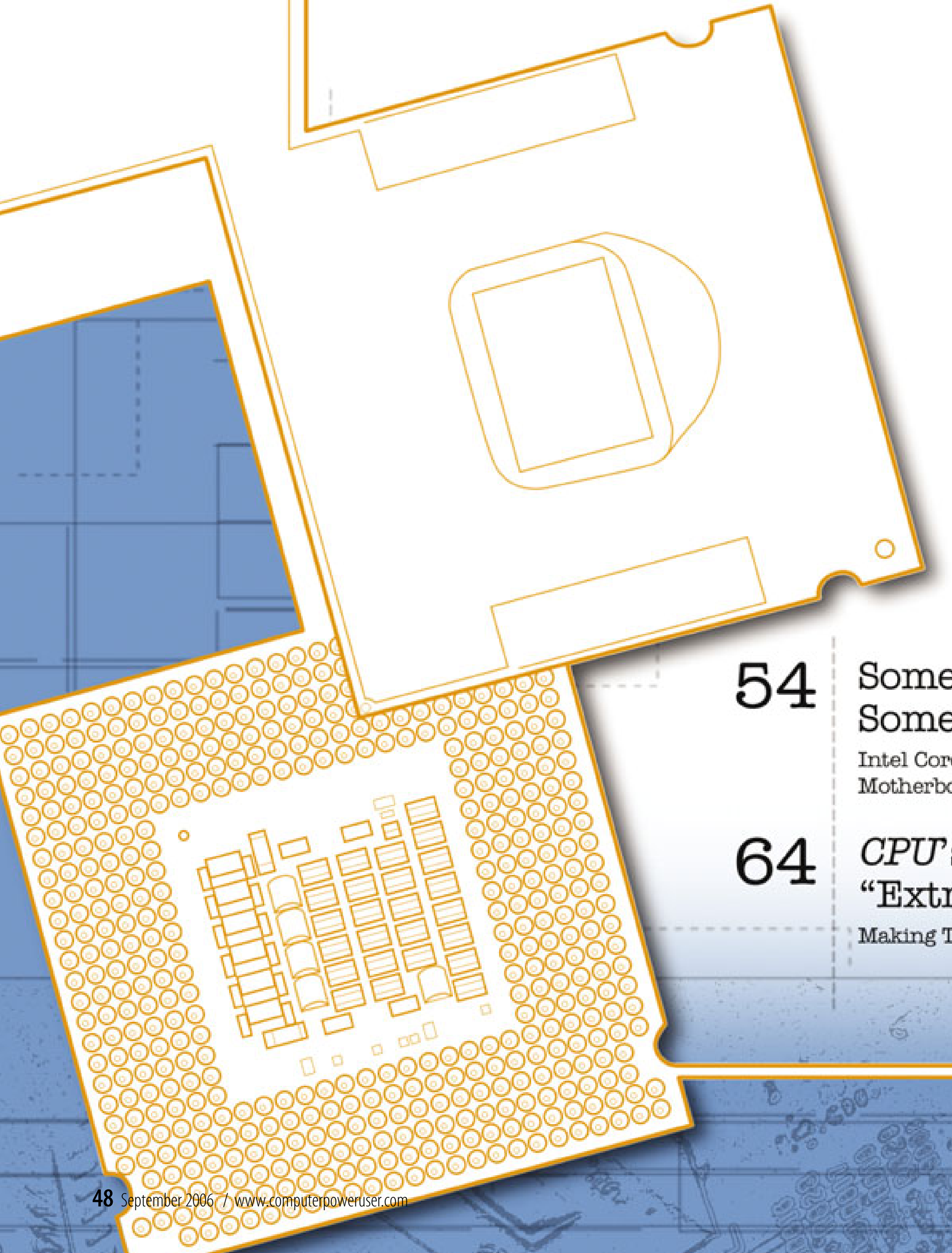
Such data could be important for tracking an animal that may have a disease. For instance, a RuBee tag could provide data that assures customers that a herd of cattle is free from disease.

You can think of each animal wearing a RuBee tag as its own Web site, with its tag providing the key data that you can access. ▲

Sources: Visible Assets, IEEE

Pentium's End

Intel Core Exposed



54 Something Old, Something New
Intel Core 2-Compatible Motherboard Roundup

64 *CPU*'s Core 2 "Extreme Machine"
Making The Fastest Even Faster

Darwin said it best: Evolve, or else. Maybe not in those exact words, but it's become pretty clear that change isn't just inevitable in this world. It's a requirement.

Consider Intel. The once-undisputed champion manufacturer of processors has been taking some serious blows in recent years from its longstanding rival, AMD. AMD's Athlon CPUs provided more bang for the buck than many of Intel's Pentium 4 counterparts, and AMD was the first to bring cost-effective 64-bit computing to the masses while Intel's Itanium remained a server-only item. Time for Intel to evolve, or else.

And evolve it has. Intel's new processor lineup, the Intel Core and Core 2, is among the most promising it has ever offered. These aren't just faster chips; they're smarter ones. Intel has learned from its competition (and its mistakes) and assembled a chipset that is at least as promising as anything AMD is now offering.

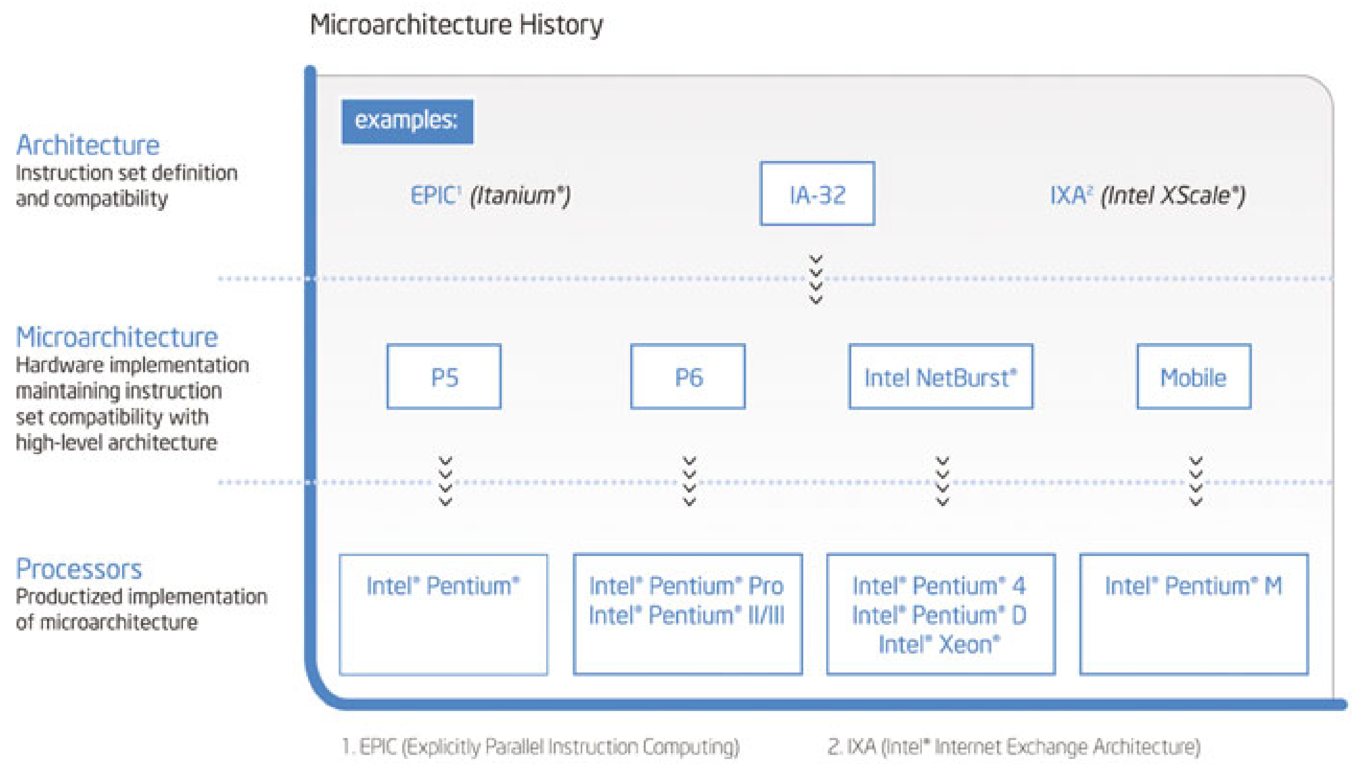
The Core Of It All

What lies at the heart of the Core processors is a series of new design philosophies that reflect basic truths about computing today. Processors have reached, for the time being, an upper plateau of practical clock speeds: Chips running at more than 3GHz are difficult to cool and impractical in other ways. Rather than run everything faster, Intel is now trying to run things smarter.

The Core microarchitecture, the basis of all Intel's new processors, rolled out in January 2006 as the replacement for the NetBurst (Pentium 4) architecture. NetBurst included some genuinely useful optimizations, including the Execution Trace Cache, which stored decoded and preoptimized CPU instructions locally (on the processor itself, for example) to allow them to be executed all the faster.

But the majority of Intel's strategy for getting the most out of NetBurst was the same as with earlier iterations of the Pentium: raw speed. Unfortunately, the most it could get was 3.8GHz or so without running into serious heat- and power-dissipation issues; you can only ramp up the clock speed so high before things literally burn up. With the power consumption of PCs becoming more of an issue, and not just on notebooks (where people's *laps* were starting to burn up), it was high time for a new approach.

Where AMD's Socket AM2 was evolutionary for AMD, Core is revolutionary for Intel—a new way of doing things that isn't just a rehash of the gigahertz treadmill. On top of everything else, Core


Microarchitecture History
examples:
Architecture
Instruction set definition and compatibility
EPIC¹ (Itanium®)
IA-32
IXA² (Intel XScale®)
Microarchitecture
Hardware implementation maintaining instruction set compatibility with high-level architecture
P5
P6
Intel NetBurst®
Mobile
Processors
Productized implementation of microarchitecture
Intel® Pentium®
Intel® Pentium® Pro
Intel® Pentium® II/III
Intel® Pentium® 4
Intel® Pentium® D
Intel® Xeon®
Intel® Pentium® M
1. EPIC (Explicitly Parallel Instruction Computing)
2. IXA (Intel® Internet Exchange Architecture)

Intel has used numerous processor architectures throughout its history. The legacy x86, or IA-32 design, has given way to a plethora of others. Now Core—itself a descendent of the Pentium M/IXA architecture, but still significantly different from both—is about to replace the NetBurst architecture, from which descended most of the current crop of Intel processors. (*Source: Intel*) and the Core 2 processor family will spell the end of the Pentium naming convention, too—probably about time, as the current CPUs are as unlike the Pentium as the Pentium was unlike its own predecessors.

Multiple flavors of Core 2 CPUs are coming out (all current releases are built on a 65nm process), of course, with each designed to eclipse an existing Pentium. The Core 2 Duo replaces the P4 and Pentium D but is binary-compatible with each. The Core 2 Extreme, with a bigger cache, replaces P4 Extreme and dual-core Pentium Extreme Edition.

Ultimately, all the Pentiums—mobile, desktop, and server—are destined to be cycled out for Core editions. Each of the Core 2 processors fits into Intel's Socket T, or LGA 775, processor socket design—a design with the pins mounted on the motherboard rather than the socket itself. (The earlier P4 EE and Pentium D processors also use this socket.)

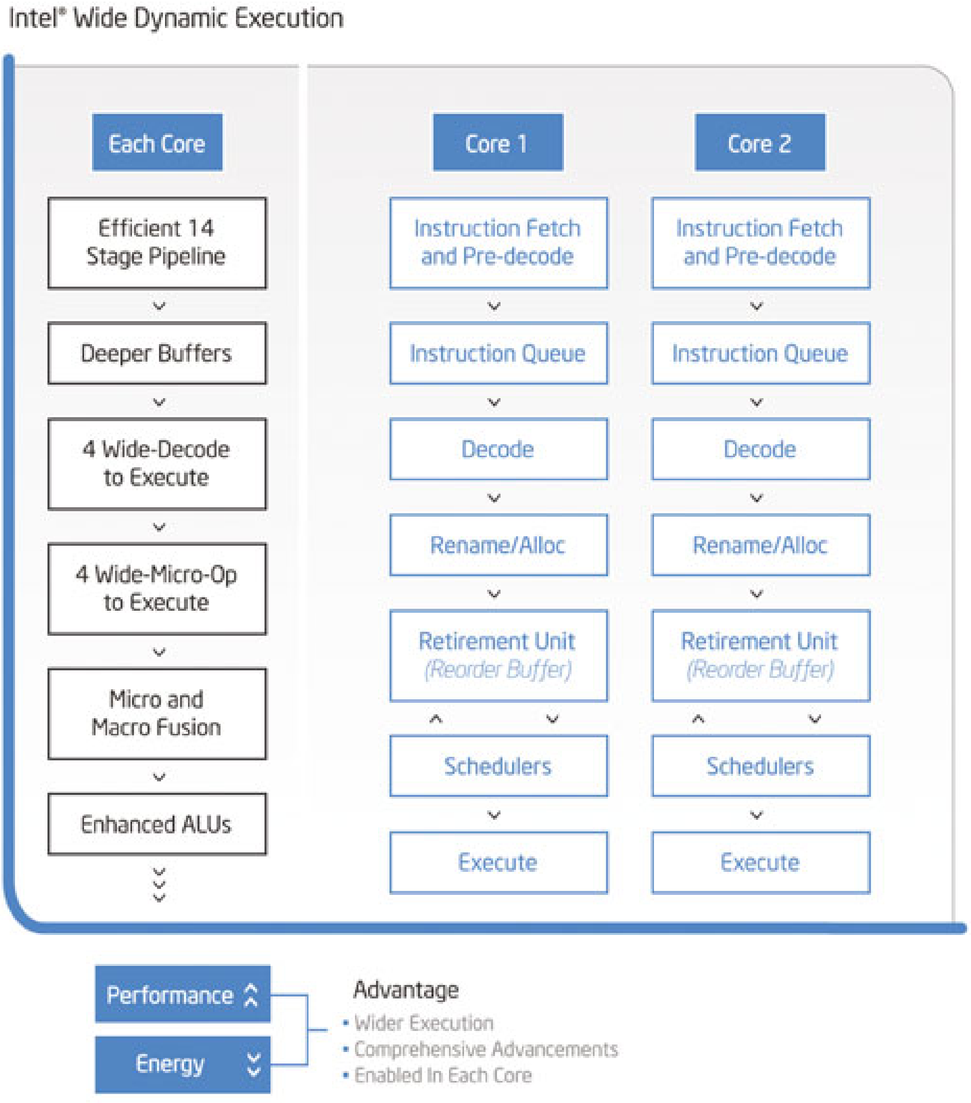
Under The Core's Hood

Here's a quick rundown of some areas where Core is genuinely different from most of its predecessors.

Four-wide architecture. The P4 used a three-wide architecture, meaning it had three pipelines, or queues for processor instructions. A big strength of Intel's processors has been their out-of-order execution and branch-prediction technologies, which let them take long reams of instructions and optimize them. Core uses four pipelines with 14 stages per pipeline, where each stage is devoted to a particular phase of how an instruction is processed—fetching, allocating, renaming, scheduling, dispatching, etc. This lets Core crank through instructions faster—four per clock cycle—because it's doing so in a more parallel fashion. The PowerPC processor, by contrast, has more pipelines than any Intel chip, but they are shorter and geared more to the PowerPC's philosophy of executing as many instructions as possible at once and getting them off the chip in a short amount of time.

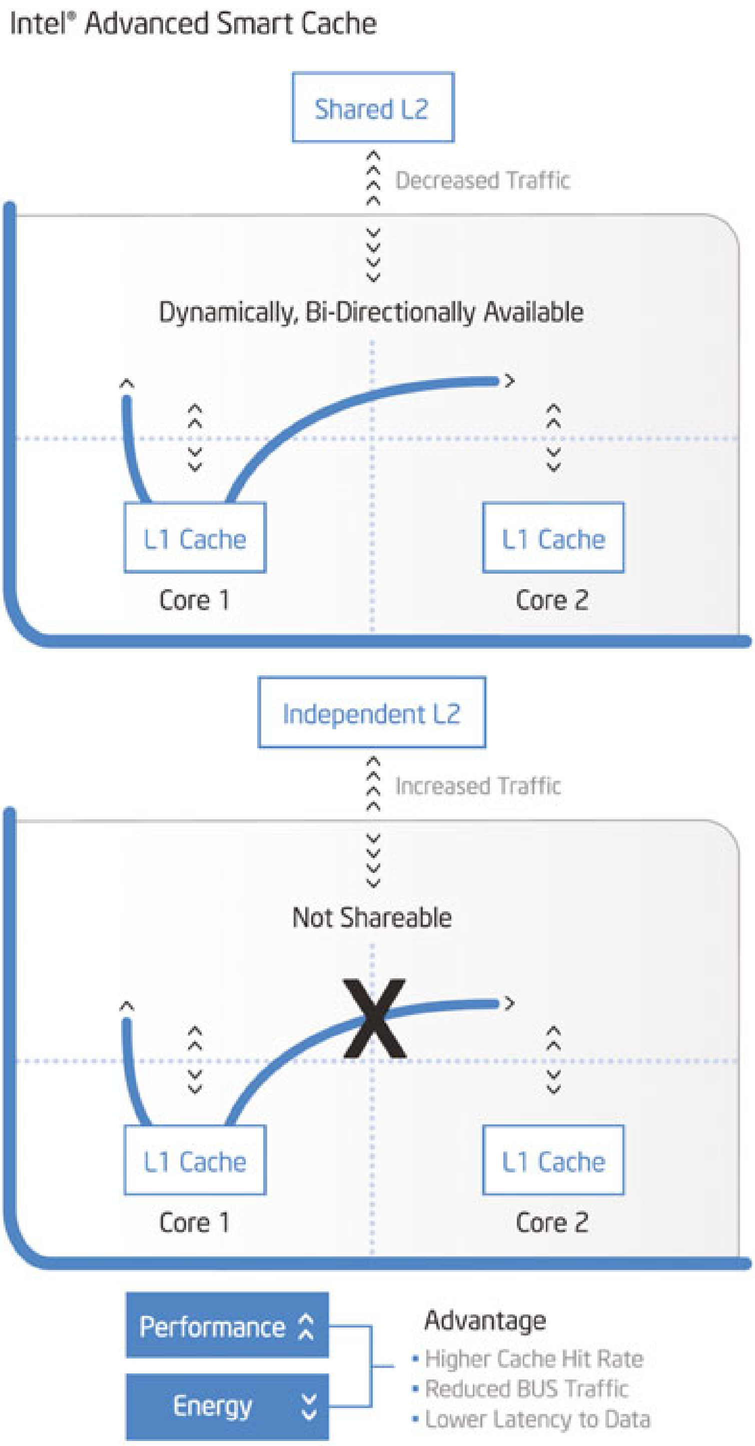
EM64T/NX/SSE4. This is Intel's implementation of the AMD64 64-bit extensions for x86 processors, which makes it possible to run 64-bit software (such as Windows XP Professional x64 Edition and 64-bit versions of Vista). In theory, 64-bitness lets the system work with much bigger sets of memory at once, process data in bigger chunks, and run better in general.

There are some minor differences between AMD64 and EM64T, but they're mostly only of interest to those doing assembly programming (writing operating systems or compilers, for example). Binaries made for one instruction set can usually run transparently on the other. It should be noted that the Pentium 4 did have EM64T instructions, but Core processors will probably be the first Intel processors to really have their 64-bitness exploited well.



Intel's four-wide architecture works in a "narrow-but-deep" method. While there are only four pipelines for instructions to the chip, many instructions can be crunched in each queue at once. (*Source: Intel*)

One fairly major omission in early Intel EM64T systems was the NX (no execute) bit, which let the chip flag parts of memory as being nonexecutable—a way to guard against viruses. Core 2 includes NX, which Windows XP has supported since SP2 and in Windows Server 2003 SP1 and the SSE4 instruction set. Originally called TNI, or Tejas New Instructions, SSE4 is the newest iteration of a set of processor features used to accelerate common math operations, and it also requires support from the OS and applications to use properly.



With two or more cores on a single chip, a shared cache cuts down on the amount of roundtrips each core has to make to system memory, thus reducing the amount of FSB traffic. (*Source: Intel*)

Secure Computing The LaGrande Way

"Secure computing" is more of a buzz phrase than ever, and Intel has a plan of its own for how to accomplish that. One of the features to coincide with the release of the new Core processors are chipsets that include the LaGrande technology, a set of provisions to secure a computer from the hardware on up. This includes, among other things, the ability to run applications in entirely isolated environments (making it impossible to hijack or spy on them); encrypted storage that is keyed to a specific computer; protected graphics and I/O; protected application launching; and "attestation," which is a way to determine that the LaGrande system is itself running properly.

LaGrande isn't something everyone will want, and to that end, it's being marketed as a specialty product for institutions and governments—at least at first. Intel states in its architectural documentation that you not only need a processor and chipset that supports LaGrande, but peripherals, graphics hardware, and a device called the Fixed Token that provides the cryptographic keys that LaGrande uses. All of this is guaranteed to cost extra.

The benefits are obvious, but there are just as many risks. Will future PCs come with LaGrande-type technologies as a mandatory add-on to enforce copy protection due to pressure from advocacy groups? Will LaGrande make it more difficult for whistleblowers to report corporate malfeasances? Even before it's actually been rolled out, it's clear that LaGrande will create at least as many thorny issues as it solves. ▲

Virtualization Technology. Putting multiple CPU cores in a single processor die was only the beginning. The next step up from that is allowing multiple OSes to run side by side. That's what VT, or Virtualization Technology, promises. VT is an implementation of a methodology, known in its development days at Intel as Vanderpool, that lets the CPU run multiple OSes at once with virtually no computational overhead.

Current processors are already doing this sort of thing in software, including Microsoft Virtual PC/Virtual Server, VMware, and the open-source hypervisor application Xen all doing this. But the software techniques used cause the OSes to take a performance hit, as much as 10% or more. VT aims to let these things occur with no perceptible decrease in performance. This would let someone, say, replace several existing Intel x86-based servers with one Intel Core server, running a virtual copy of each original server's OS side by side.

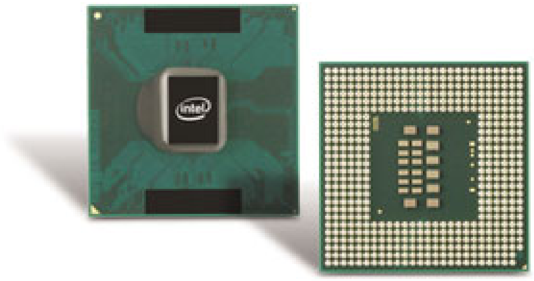
The current release of Xen (which is Linux-only) already supports Intel VT, and plans are on the table for Virtual PC and VMware to support it, too. AMD has a similar technology in the works codenamed Pacifica, but the Vanderpool and Pacifica implementations of VT aren't compatible; you need to implement them differently for each processor.

Macro-Ops Fusion. One of the ways Intel has consistently looked at getting more out of every processor is by having it do more things at the same time, such as process more instructions, fetch more memory for local caching, etc. Macro-Ops Fusion is Intel's term for a new Core technology that allows two x86 instructions to run as a single internal instruction. This would let the CPU optimize the running of legacy x86 instructions as much as possible, and because there's no sign that 32-bit x86 code will go away any time soon, this is highly useful.

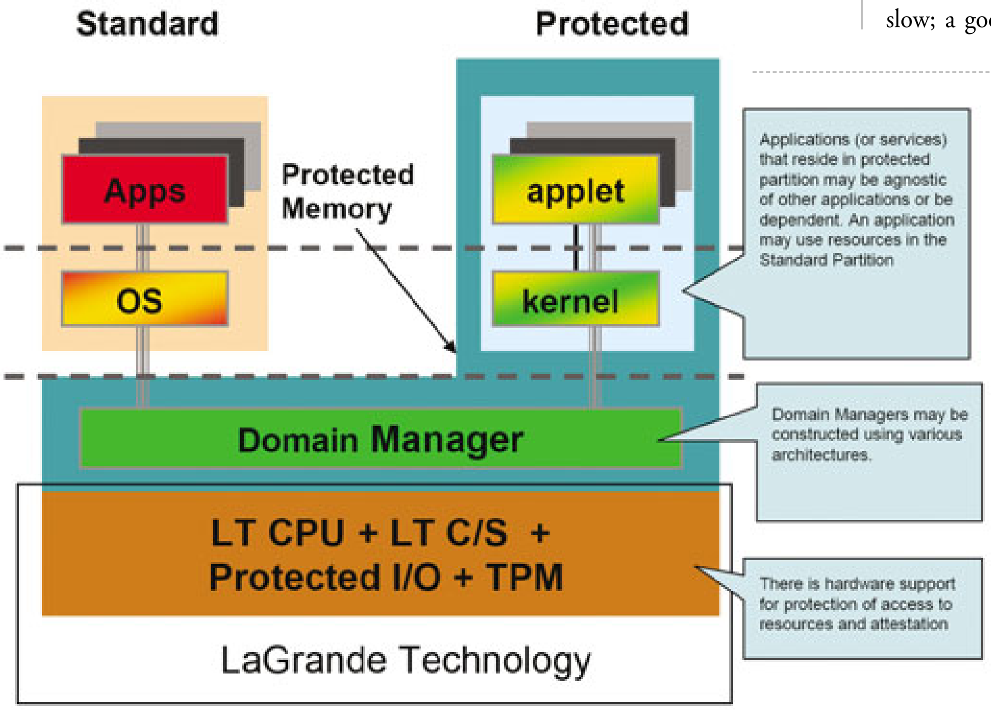
Reduced power consumption. One other key feature that Intel is stressing hard with Core is reduced power consumption. AMD has long been touting the value of CPUs that use less wattage, and Intel is following suit. Conroe uses about 65W by default, but the single-core Millville is only 31W, and Merom for notebooks and tablets only uses anywhere from 35 to 15W. There's even an ultra-low-voltage version of the Core lineup in the offing, which would use as little as 1 to 5W at a bit of a performance hit, but less than you might expect for something that economical.

Taking The Wrong Bus?

The one area where Intel may run into a serious future performance-stumbling block is how the Core processors deal with memory. The path from a computer's memory to the CPU is notoriously slow; a good deal of a processor's wasted



The Intel Core Duo



Applications (or services) that reside in protected partition may be agnostic of other applications or be dependent. An application may use resources in the Standard Partition

Domain Managers may be constructed using various architectures.

There is hardware support for protection of access to resources and attestation

The LaGrande security technology, which works with Core processors that feature it, can allow different aspects of a computer (kernel, applications, and memory) to be segregated from each other and policed. In order for the system to be completely effective, though, it requires a computer that has been engineered with LaGrande in mind from end to end. (*Source: Intel*) time is spent waiting around for the memory to respond. There have been numerous ways to speed this up, including placing L1 and L2 caches of memory directly on the CPU or speeding up the pathway from the processor to the memory.

AMD took the latter approach and created the interconnect HyperTransport system to lessen the latency between memory and CPU. Intel, however, still uses the older FSB technology for memory access. The problem with the FSB is that it also provides a data pathway for other components, so it's shared with other things and consequently slower overall.

To make up for this, Intel plans to run the FSB as fast as possible: 1,066MHz for the basic Conroe version of Core 2, 1,333MHz for the higher-end Woodcrest server processors, and 667MHz for Merom. Intel is also using a large on-die L2 processor cache—2MB *minimum* across the Core—to make up for any latency to memory. The L2 cache is also shared across both cores; if each core needs to access the same bit of cached memory, they can both do so without having to make a roundtrip to system memory. The caching between cores can also be balanced, a technique Intel called Advanced Smart Cache.

So far these strategies for lessening the FSB's bottlenecks may be paying off. AnandTech.com ran tests of the Core 2 Extreme X6800 (a Conroe CPU with 4MB L2 cache running at 2.93GHz) as compared against an AMD Athlon 64 FX-62 (2.8GHz with 512KB L2 cache). The site found that while memory latency (as measured with ScienceMark 2.0) between the two processors was comparable, the memory bandwidth for the Core 2 was only about 65% of the bandwidth of the FX-62. In terms of real-world performance, the Core 2 consistently beat the FX-62 in many popular applications, from content creation to games, and by a fairly wide margin.

That said, these tests were only conducted on computers with *one* physical processor. AMD/HyperTransport may prove the better choice over Core 2 machines with multiple physical processors (as opposed to multiple cores on one processor). The good news is that multiple cores on one processor may be the default in the future, so for most people the Intel Core 2 may prove the better practical solution after all.

In fact, Intel may already be readying for a transition to a new bus technology, but the details are sketchy at best. One thing that has been announced for the Tigerton—a Core-based, Xeon-grade server processor expected in 2007—is "a new, high-speed interconnect." However, Intel spokesman Scott McLaughlin stated in an interview reported around the Web that the new interconnect is designed more to connect multiple physical processors to each other rather than provide dedicated memory lanes, so it seems to be primarily for server environments anyway.

Conclusions

The Core has incredible promise, some of which is already being fulfilled. It shows a genuinely new direction for Intel, away from the old formula of "more and faster." It's also heartening to see Intel pay more attention to reduced power usage, something becoming more urgent as energy costs climb.

Still, to make sure the Core can really shine, Intel can and should also do away with as many legacy structures as it can, such as depending on the FSB for memory access—something third parties have urged it to do, as well. Here's hoping it keeps evolving. ▲

by Serdar Yegulalp

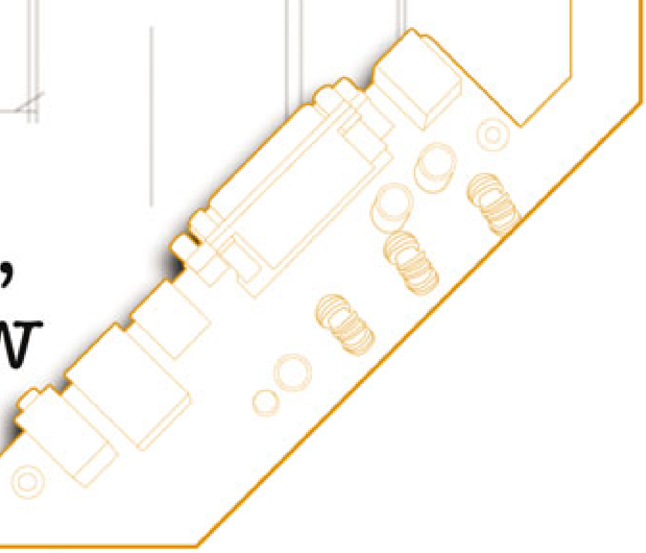
The Core Clan

These are the codenames and specifications for many present and future iterations of Core 2 processors. The most striking thing about all the processors here is the cache sizes. A decade ago, there were whole PCs that didn't have 8 or 12MB of RAM; now the L2 cache of the Core processors can reach that high. (The Tigertown/Dunnington/Harpertown chip information is highly speculative at this point, as most reports on these have been little more than extrapolation about Intel's own tentative hints.) ▲

Processor	Fab Process	Cores	L2 Cache	Speed	Wattage
Desktop Processors					
Conroe	65nm	2	4MB	1.6 to 2.67GHz	65W
Conroe XE	65nm	2	4MB	2.4 to 2.67GHz	80W
Allendale	65nm	2	2MB	1.6 to 2.4GHz	65W
Millville	65nm	1	2MB	1.6 to 2.4GHz	31W
Wolfdale	45nm	2	3MB	1.6 to 2.4GHz	65W
Kentsfield	65nm	4	8MB	1.6 to 2.4GHz	N/A
Yorkfield	45nm	8	12MB	1.6 to 2.4GHz	N/A
Ridgefield	45nm	2	6MB	1.6 to 2.4GHz	31W
Perryville	45nm	1	2MB	1.6 to 2.4GHz	15W
Notebook Processors					
Merom	65nm	2	2 to 4MB	1.6 to 2.3GHz	35W
Penryn	45nm	2	3 to 6MB	1.6 to 2.3GHz	35W
Perryville	45nm	1	2MB	1.6 to 2.3GHz	15W
Server/Workstation Processors					
Woodcrest	65nm	2	4MB	1.6 to 3GHhz	65W
Clovertown	65nm	4	8MB	1.6 to 3GHhz	80W
Tigerton(1)	65nm	4	8MB	1.6 to 3GHhz	80W
Harpertown (1)	45nm	2	4MB	1.6 to 3GHhz	65W
Harpertown (2)	45nm	8	12MB	1.6 to 3GHhz	80W
Dunnington	65nm	4 to 32	12MB	1.6 to 3GHhz	N/A

Something Old, Something New

Intel Core 2-Compatible Motherboard Roundup



It has been a tough few years for Intel. AMD's Athlon 64 processor line has taken it right to Intel on multiple fronts since the FX-51 was introduced in September 2003. From then on, both single and dual-core flavors of the Athlon 64 have consistently outperformed Intel's equivalent desktop offerings at almost every price point. To make matters worse for Intel, AMD's processors have typically run cooler and consumed less power.

Additionally, numerous enthusiast-class, Athlon 64-compatible motherboards have also been released over the years, which has further enhanced the attractiveness of AMD's platform as a whole. In fact, some users would argue that the number of excellent Athlon 64 motherboards released in the last few years was an integral part of the Athlon 64's success, including the Asus SK8V and A8N-SLI Premium, MSI K8N Neo2 Platinum, and almost every board in DFI's LANParty lineup. There have also been excellent boards from Epox, Abit, and Gigabyte that have rated highly with enthusiasts. The AMD platform as a whole has had "power user" written all over it.

The performance scene is about to undergo a major transformation, however. With July's release of Intel's Core 2 Duo and Core 2 Extreme processors, AMD can no longer lay claim to the overall performance crown. Intel once again has a desktop processor lineup to be proud of. The microarchitecture that's at the heart of the Core 2 CPUs is a giant leap forward in terms of efficiency and performance per watt. In our testing we found that a 2.66GHz Core 2 Duo E6700 consistently outpaced a 2.8GHz Athlon 64 FX-62. On top of that, the E6700 has an MSRP of $530—roughly half that of the FX-62, as of this writing.

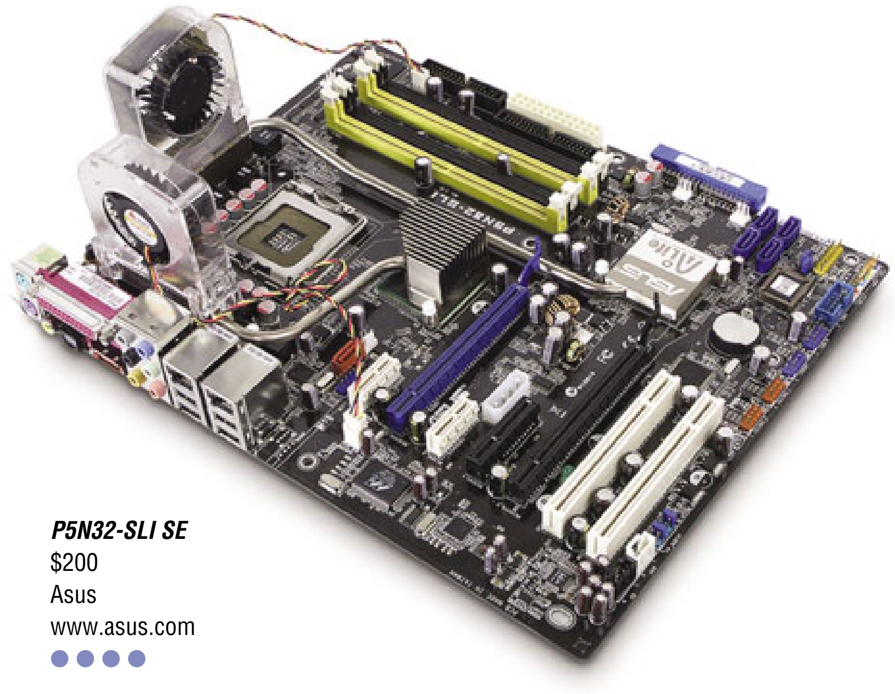
On the surface it would certainly seem Intel's new CPUs are bound to find their way into many enthusiasts' system. For the Core 2 Duo to be as ubiquitous as the Athlon 64 has been among power users recently, however, the CPU has to nestle into a killer motherboard. Somewhat surprisingly, the initial lineup of Core 2-compatible motherboards is relatively thin. We hit up a number of OEMs for Core 2-compatible boards, but only Asus and Intel delivered retail-ready motherboards in time for the processor's launch. Nvidia provided a reference nForce 590 SLI board, but it's an engineering sample that won't be available on store shelves. We know Abit, DFI, Gigabyte, MSI, ECS, Epox, and others will have Core 2-compatible mobos available soon, however. As you read this, Core 2 motherboard madness will likely be in full swing.

The boards we did procure do paint a clear picture of the overall Core 2 motherboard landscape. All the motherboards are based on different core logic chipsets, except for the Intel D975XBX and Asus P5W DH Deluxe, which the 975X Express powers.

The Motherboards

Asus P5N32-SLI SE

The Asus P5N32-SLI SE is a revision to a motherboard we've seen previously, the P5N32-SLI Deluxe. The two boards are



P5N32-SLI SE
$200
Asus
www.asus.com
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Asus P5N32-SLI SE Specifications:

Chipset: Nvidia nForce4 SLI x16

Audio: Realtek ALC850 AC'97 (8-channel)

Ethernet: Marvel 88E1115

PCI-E x16 slots: 2

PCI-E x1 slots: 2

PCI-E x4 slots: 1 (slotted)

PCI slots: 2

SATA ports: 6 (5 internal/1 eSATA)

IDE channels: 2

RAID support: 0, 1, 0+1, JBOD

Chipset/VRM cooling: passive/passive

technically very similar, with the new motherboard essentially being a revision 2.02G of the P5N32-SLI Deluxe. Most features are unchanged in the revision, except for the P5N32-SLI SE's updated BIOS and revamped VRM, which fully support the Core 2 Duo and Core 2 Extreme processors' new voltage and microcode requirements.

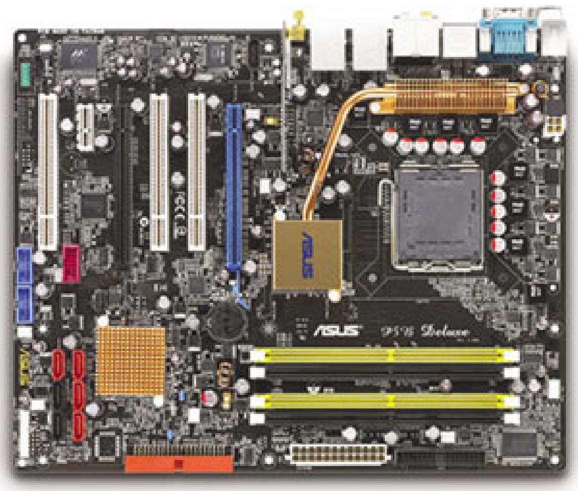
Asus typically bundles its high-end motherboards with a multitude of accessories and value-added extras. This is true with the P5N32-SLI SE. The board comes with an assortment of cables, cords, and other connectors and gadgets. We found four SATA cables in the box to compliment the four SATA power adapters also included. That's a good amount of cables, considering the P5N32-SLI has five internal SATA ports onboard. Additionally, there were two flat, black ribbon cables for a floppy drive and IDE devices. We also received a trio of optional case brackets, including one with a FireWire port, another housing two USB 2.0 ports and a game/MIDI port, and one with a legacy serial port.

Rounding out the bundle are a custom I/O shield, a pair of optional fans you can mount to the board's VRM heatsinks, and an SLI connector that's long enough to support the extra spacing between the P5N32-SLI SE's PEG slots. Asus also provides a manual and driver CD, WinDVD suite, and case badge. The driver CD includes typical chipset and component drivers, plus utilities from Asus and Nvidia, including Nvidia's firewall and Asus' PC Probe 2.

In general, the P5N32-SLI SE's layout is good. The SLI-capable board has two PCI-E x16 slots, two PCI-E x1 slots, one slotted PCI-E x4 slot, and two standard PCI slots. The slots are configured in such a way that when you install two double-wide graphics cards, one x1 slot, the x4 slot, and one PCI slot are all available. The layout leaves plenty of expansion possibilities, even when a pair of graphics cards is installed in an SLI configuration. It's worth noting that the x4 slot is slotted, so you can install x8 and x16 expansion cards with longer connectors in the slot, as well, albeit with less than optimal bandwidth available.

The P5N32-SLI SE's power connectors, ports, and expansion headers are all situated in good positions. An 8-pin 12V ATX power connector sits at the board's top corner. Along the front edge behind the DIMM slots is a single floppy connector, two IDE ports, and the 24-pin ATX power connector. Just behind the lower IDE port are four SATA ports, which all remain useable with two graphics cards installed. With two cards installed, the SATA ports sit right between the cards—not optimal but better than sacrificing the ports altogether, as is the case with some SLI motherboards. The P5N32-SLI SE's optional FireWire, USB, front panel audio, and case headers sit along the board's bottom edge. Every connector is color-coded and clearly labeled, which makes hooking the board up quick and painless.

A couple of passive heatsink and heatpipe assemblies handle the cooling duties. The components in the P5N32-SLI SE's eight-phase voltage regulator module are split along two sides of the CPU socket. Those along the back edge are adorned



P5B Deluxe WiFi-AP Edition
$265
Asus
www.asus.com
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Asus P5B Deluxe WiFi-AP Edition Specifications:

Chipset: Intel P965
Audio: ADI AD1988B HD (8-channel)
Ethernet: Marvell 88E8001
PCI-E x16 slots: 2
PCI-E x1 slots: 1
PCI slots: 3
SATA ports: 8 (7 internal/1 eSATA)
IDE channels: 1
RAID support: 0, 1, 0+1, 5, 10, JBOD
Chipset/VRM cooling: passive/passive

with a heatsink, which also has a heatpipe leading to the heatsink mounted atop the nForce4 SLI x16 SPP, which is in the traditional northbridge position. The nForce4 SLI x16 MCP in the southbridge position also has a heatsink mounted to it, but with a heatpipe leading to the remaining components in the VRM. Asus calls this a "two-slot thermal design," and it functioned well in our testing. The nForce4 SLI x16 is a relatively hot running chipset, though, so have good air circulation in your case to keep the heatsinks cool.

One of this board's strong points is its BIOS, which is full of enthusiast-oriented features. From within the BIOS, you can enable or disable any of the integrated peripherals; tweak numerous voltages, including CPU, chipset, and RAM; and dial-in the FSB and memory frequencies individually. Through the BIOS we took a Core 2 Extreme X6800 all the way up to 3.55GHz without a hiccup, while specifying the speed of the RAM, as well.

The P5N32-SLI SE's external I/O backplane has two PS/2 mouse and keyboard ports, one parallel port, optical and coaxial SPDIF outputs, an eSATA port, six audio inputs and outputs, four USB 2.0 ports, and two LAN jacks. Dual GbE functionality comes the way of a Marvel PHY coupled to the nForce4 chipset and an additional Marvel controller. A Realtek ALC850 AC'97 codec handles audio; the board doesn't have HD audio functionality.

The P5N32-SLI SE gets high marks for its tweakability and performance. Additionally, until retail nForce 590 SLI Intel Edition boards hit, the nForce4 SLI x16 chipset that this board uses is the best choice for users wanting a dual-card SLI setup.

Asus P5B Deluxe WiFi-AP Edition

The P5B Deluxe WiFi-AP Edition is the only retail-ready motherboard we looked at here that's based on a new core logic chipset. Intel recently released the P965 chipset, which is at the heart of this board, to support impending Core 2 Duo and Extreme CPUs. The "P" in P965, along with the chipset's timely release just prior to the introduction of the Core 2 line, would imply that this is Intel's performance chipset, but it's not. The P965 is actually being marketed as a mainstream chipset. As such, many motherboards based on the P965 should command a more palatable mainstream price than the current batch of flagship 975X Express offerings. The P5B Deluxe WiFi-AP isn't one of these, however. This board is pricey.

With the P965, Intel is introducing the ICH8, a new I/O controller hub that has six SATA 3Gbps channels, six PCI-E lanes, Matrix Storage Technology, 10 USB ports, and High Definition Audio and GbE support. Noticeably absent from the ICH8's specs is PATA support. With this chipset Intel is going all SATA, which means we'll likely see an influx of SATA optical drives in the not-so-distant future. Asus, however, went the extra mile and incorporated a third-party controller to add legacy PATA functionality to the P5B Deluxe.

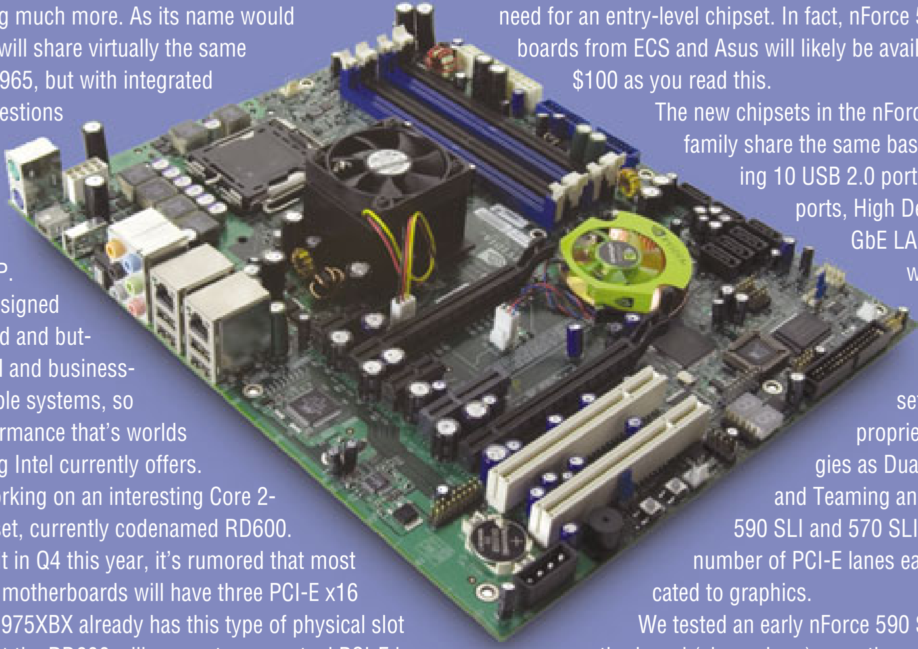
Another notable difference between the P965 and 975X Express is the chipset's

PCI-E lane configuration for graphics. Where the 975X Express has the flexibility to be set up in a 16 x 1- or 8 x 8-lane configuration when dual graphics cards are used, the P965 will offer only 16 x 4- and 16 x 2-lane configurations. On the P5B Deluxe, you can configure the second PCI-E x16 slot with either two or four lanes of electrical connectivity.

As a new member of Asus' AI Lifestyle line, the P5B Deluxe WiFi-AP Edition is loaded with features. In typical Asus fashion, the board is crammed with integrated peripherals, including an 802.11g wireless NIC. Other features include dual-PEG slots, power LEDs that illuminate an Asus logo, an eight-phase power array, FireWire support, and dual GbE LAN. There's also such Asus proprietary features as AI NOS (automatic overclocking), AI Gear (overclocking/power profiles), and AI Nap (low-power standby). As mentioned, although the board has the ICH8, it does have a PATA port by way of a JMicron JMB363 PATA/SATA controller that also powers the P5B Deluxe's eSATA port.

Considering the motherboard's wealth of integrated peripherals, the layout is good. Like the P5N32-SLI SE, the P5B's 8-pin 12V ATX power connecter is mounted at the board's upper corner. The 24-pin ATX

Coming Attractions: More Core Logic For Core 2



Although Intel's new Core 2 Duo and Core 2 Extreme processors are compatible with most of today's existing core logic chipsets, all major OEMs are preparing new chipsets for the CPUs, as well. For this roundup we had the relatively new P965, the 975X Express, the nForce4 SLI x16, and an early revision of Nvidia's nForce 590 SLI all represented. Intel, however, is also working on new Core 2-compatible chipsets with more PCI-E lanes dedicated to graphics, retooled memory controllers, and more powerful integrated graphics.

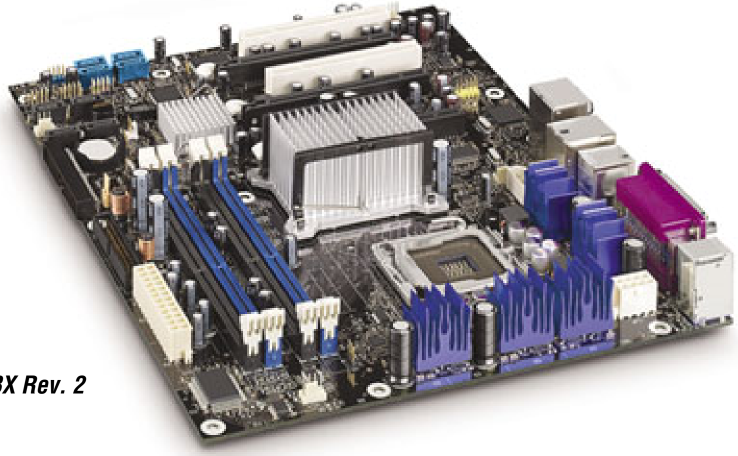
Some details are available regarding Intel's G965 chipset, which will feature a Vista-friendly DirectX 9.0c IGP, but Intel is tight-lipped concerning much more. As its name would imply, the G965 will share virtually the same features as the P965, but with integrated graphics. The questions that remain concern the performance and capabilities of the G965's IGP. The chipset is designed to be Intel's bread and butter for entry-level and business-class Vista-capable systems, so expect IGP performance that's worlds ahead of anything Intel currently offers.

ATI is also working on an interesting Core 2-compatible chipset, currently codenamed RD600. When ATI ships it in Q4 this year, it's rumored that most RD600-powered motherboards will have three PCI-E x16 slots. The Intel D975XBX already has this type of physical slot configuration, but the RD600 will support more actual PCI-E lanes, so each slot will likely have more electrical connections. ATI's goals with the RD600 will be to offer full-bandwidth CrossFire compatibility using a pair of PEG slots, with the third PCI-E x16 slot being used for an additional graphics card to handle physics calculations. ATI has been showcasing a system featuring three graphics cards in physics demos, so the rumors look true. The RD600 will be coupled with the upcoming SB600 southbridge and share many features and specifications with the currently available RD580, or the CrossFire Xpress 3200.

Of course, Nvidia has an entire family of chipsets with Core 2 support on the way, as well. In addition to the existing nForce4 SLI x16, the midrange and high-end chipsets in the nForce 500 family available for the Socket AM2 platform will be coming to Core 2. The nForce 500 Intel Edition family now includes the new flagship nForce 590 SLI and the nForce 570 SLI chipsets. It's unclear if the nForce 570 Ultra and nForce 550 will make it to the Intel camp, however, as the 570 SLI will be relatively inexpensive, somewhat negating the need for an entry-level chipset. In fact, nForce 570 SLI Intel Edition boards from ECS and Asus will likely be available for less than $100 as you read this.

The new chipsets in the nForce 500 Intel Edition family share the same base feature set, including 10 USB 2.0 ports, six SATA 3Gbps ports, High Definition Audio, dual-GbE LAN, and MediaShield with RAID 5 support. In addition, the nForce 500 Intel Edition chipsets also have such proprietary Nvidia technologies as DualNet with FirstPacket and Teaming and SLI Memory. The 590 SLI and 570 SLI differ only in the number of PCI-E lanes each chipset has dedicated to graphics.

We tested an early nForce 590 SLI Intel Edition motherboard (shown here) recently and included its performance characteristics in the "Core 2 Motherboard Performance Comparisons" sidebar. Overall, the board performed very well, but it wasn't on the same level as the P5N32-SLI SE, which the nForce4 SLI x16 powers. When retail nForce 590 SLI Intel Edition motherboards hit the streets, though, we expect performance to slightly exceed the nForce4. By then OEMs will have had time to tune their boards and BIOSes for optimal performance. ▲



D975XBX Rev. 2
$249
Intel
www.intel.com
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Intel D975XBX Rev. 2 Specifications:

Chipset: Intel 975X Express
Audio: Sigmatel STAC9221D HD (8-channel)
Ethernet: Intel82573V or 82573L
PCI-E x16 slots: 3
PCI-E x1 slots: 0
PCI slots: 2
SATA ports: 8
IDE channels: 1
RAID support: 0, 1, 10, 5, JBOD
Chipset/VRM cooling: passive/passive

power connector and floppy and IDE ports sit along the front edge. The board's bottom edge is lined with all the P5B Deluxe's optional expansion and front-panel headers. The board's dual PCI-E x16, triple PCI, and single PCI-E x1 slots are configured so that two PCI slots are still usable if two double-wide graphics cards are installed. The VRM, northbridge, and southbridge are all passively cooled.

Asus went a bit over the top in regards to the board's bundle. We found six right-angle SATA cables, three Molex-to-SATA adapters, a custom I/O shield, an optional fan for the VRM heatsink, two user manuals, a driver CD, and a Media Launcher CD that contained a sampling of InterVideo apps (including the WinDVD suite). Additionally, the board shipped with Asus' proprietary Q-Connectors; a case badge; a SoundMAX Superbeam microphone; a Wi-Fi antenna; and several case brackets, including one with a FireWire port and one with two USB 2.0 ports.

The P5B Deluxe has a very complete system BIOS, which you'll find loaded with overclocking and performance-related features. Although Intel doesn't officially support it, this board lets you dial in RAM frequencies of 1,066MHz and higher without overclocking the processor. There are various tweakable voltages, as well. Using the board and a combination of multiplier, voltage, and FSB tweaks, we had no trouble taking our Core 2 Extreme X6800 to well over 3.5GHz. This board may be based on a mainstream chipset, but make no mistake, it's clearly also targeted at power users and overclockers.

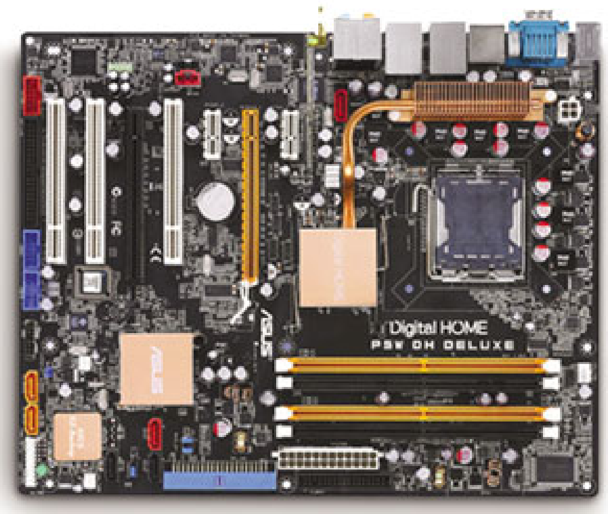
The board's backplane includes PS/2 mouse and keyboard ports; one serial, eSATA, and FireWire port; coaxial and optical SPDIF outputs; six 1/8-inch audio inputs and outputs; four USB 2.0 ports; two RJ-45 LAN jacks; and a connector for the integrated Wi-Fi controller's external antenna.

Throughout our testing the P5B Deluxe proved a rock-solid, high-performing Core 2 board. If you are looking for a stable, feature-rich Core 2 motherboard and you don't plan to use multiple graphics cards, the P5B Deluxe WiFi-AP Edition will serve you well.

Intel D975XBX Rev. 2

To test its new Core 2 Duo and Core 2 Extreme CPUs, Intel supplied analysts with a new revision of its D975XBX "BadAxe" motherboard, which is based on Intel's current flagship 975X Express chipset. The 975X Express is very similar to the older 955, but the 82975X northbridge with the 975X has a more flexible PCI-E lane configuration. The 975X Express chipset supports all Intel LGA755 processors with 800MHz/1,066MHz bus speeds and supports up to 8GB of DDR2-533 to DDR2-800 RAM (with or without ECC). The memory controller also incorporates Intel's Memory Pipeline Technology, which accelerates transfers between the system memory and CPU. The second main component in the 975X chipset is the ICH7R southbridge, which has full support for Intel's Matrix Storage Technology (RAID 0, 1, 5, 10, and JBOD), Intel Active Management Technology, and High Definition audio.

CPU RANKING ○ 0 = ABSOLUTELY WORTHLESS | ●●◖ 2.5 = ABSOLUTELY AVERAGE | ●●●●● 5 = ABSOLUTELY PERFECT



P5W DH Deluxe
$270
Asus
www.asus.com
●●●●

Asus P5W DH Deluxe Specifications:

Chipset: Intel 975X Express

Audio: Realtek ALC882M (8-channel)

Ethernet: Marvell 88E8053 x 2

PCI-E x16 slots: 2

PCI-E x1 slots: 1

PCI slots: 3

SATA ports: 7 (6 internal/1 eSATA)

IDE channels: 2

RAID support: 0, 1, 10, 5, JBOD

Chipset/VRM cooling: passive/passive (optional fan)

Unlike most other Intel desktop boards, the D975XBX Rev. 2 has a host of enthusiast-oriented features that give you the ability to alter voltages and bus speeds and to easily overclock the CPU. Although there was no official name change, the new Core 2-compatible revision of this board that we looked at hit the channel quietly, so we'll refer to it as the D975XBX Rev. 2, just to be clear that this is a new addition to Intel's mobo lineup. The D975XBX Rev. 2's features and specifications are some of the best for enthusiast-class LGA775 motherboards now available. The board has three physical PCI-E x16 slots (with varying electrical connections) and it supports ATI's CrossFire technology. Nvidia's SLI technology isn't supported, however. By inserting a second video card, the first and second PEG slots' PCI-E lane configuration is automatically changed to an 8 x 8 configuration. The third slot is always by four PCI-E lanes.

The D975XBX Rev. 2 has an updated five-phase power array, which was necessary to make the board Core 2-compatible, and each FET in the array is adorned with a relatively large aluminum "flame" heatsink. The motherboard's northbridge and southbridge also have their own aluminum heatsinks. All-passive cooling means the board doesn't generate any noise of its own, but make sure there's good air circulation in your case for reliable operation. The ICH7R I/O controller hub controls four of the board's eight SATA ports, and a Silicon Image controller handles the other four. The D975XBX Rev. 2 also has four DDR2 DIMM slots, GbE, and High Definition Audio support by way of a Sigmatel STAC9221D 8-Channel HD codec.

The D975XBX Rev. 2's BIOS is relatively Spartan compared to some other boards we've looked at here, but all the necessities are there. Intel does incorporate a few annoying disclaimers, however, and buries the overclocking options a few levels deep in the Advanced portion of the system setup section in the BIOS. When you install an Extreme Edition (Pentium or Core 2) CPU, you can alter the CPU's multiplier, as well as the FSB speed and numerous voltages. The board's backplane houses a pair of PS/2 mouse and keyboard ports; single parallel and serial ports; eight various audio ports, including a coaxial SPDIF output; four USB 2.0 ports; one FireWire port; and an RJ-45 LAN jack.

Overall, the D975XBX Rev. 2 is a solid motherboard that's priced a bit on the high side. Its performance and Intel's excellent build quality are definite plusses, however.

Asus P5W DH Deluxe

The P5W DH Deluxe is easily one of the most impressive motherboards we've come across. By now, you know Asus loves to load its high-end motherboards with various integrated peripherals. With the P5W DH Deluxe, however, Asus redefines the meaning of feature-rich. If future products in Asus' DH (Digital Home) line are as capable as this board, consumers will undoubtedly be impressed.

Like Intel's D975XBX, the P5W DH Deluxe is based on Intel's 975X Express

Core 2 Motherboard Performance Comparisons

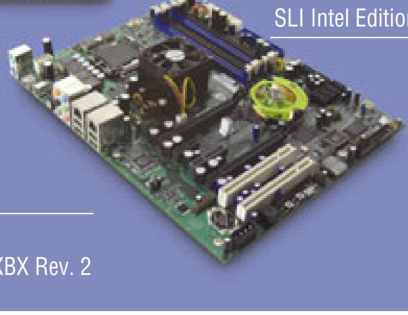
Although a majority of the boards we tested for this roundup came from Asus, we expected performance to vary, as most of the boards were built around a different core logic chipset. On the AMD Athlon 64 platform, motherboards perform similarly because a major component traditionally in the northbridge (the memory controller) resides on the processor die itself. On the Intel side, though, even with the new Core 2 processors, the CPU communicates with system memory through a memory controller integrated into the northbridge. Additionally, the Nvidia nForce and Intel chipsets here feature different memory controllers.

To test our boards, we used Intel's current flagship Core 2 Extreme X6800 processor (2.93GHz), a 1GB Corsair TWIN2X1024-8500C5 memory kit, a Western Digital Raptor 74GB hard drive, and a GeForce 7900 GTX. We enabled each board's respective integrated sound and Ethernet controllers. Before we began testing, we also entered each motherboard's system BIOS and set it to the high performance or optimized defaults when applicable. Each system ran on Windows XP Pro SP2 with DirectX 9.0c (June distribution) and Nvidia's ForceWare v91.33 drivers installed for the GeForce 7900 GTX. The nForce4 SLI x16-powered P5N32-SLI SE used Nvidia's nForce v6.86 drivers, the 590 SLI reference board used the nForce v9.35 drivers, and the other boards used Intel's INF v8.0.1.1002 drivers.

We expected some measurable performance differences across the different chipsets, but we didn't see that. Mostly, all the boards performed at similar levels. Many smaller performance deltas here fall well within the margin of error for the particular benchmark test. Overall, though, two boards earned the lion's share of first-place finishes: the P5N32-SLI SE and the P5W DH Deluxe. Either board would make a strong foundation to a power a user's system. ▲

Asus
P5B Deluxe
WiFi-AP Edition

Asus
P5W DH Deluxe



Nvidia nForce 590
SLI Intel Edition

Asus
P5N32-SLI SE

Intel
D975XBX Rev. 2

chipset. The 82975X northbridge is coupled to an ICH7R I/O controller hub, and both chips have aluminum heatsinks with copper shrouds that read Digital Home. The heatsink on the northbridge is also linked to an oversized copper heatsink mounted to the components in the VRM. The rest of the board's layout is generally good, with the exception of the placement of the primary IDE channel, which is at the board's bottom edge in an awkward position beneath the last PCI slot.

The 4-pin 12V ATX power connector sits at the board's top corner behind the I/O backplane. Along the front edge behind four DIMM slots are the 24-pin ATX power connectors, a floppy connector, and the secondary IDE channel. Three SATA ports sit along the right near the ICH7R southbridge, with two more at the bottom corner. Another SATA port sits just behind the VRM, and an eSATA port sits on the I/O backplane. The remainder of the P5W DH Deluxe's various headers are all clearly labeled and lined along the board's bottom edge.

The P5W DH Deluxe's slots are an alternating mix of dual PEG slots, dual PCI-E x1 slots, and three standard PCI slots. The board is CrossFire ready, and even with two double-wide X1900s installed, there are two PCI slots and one PCI-E X1 slot available. Considering the motherboard's already impressive list of features, having this much expansion available with two cards installed is definitely a plus. Not many motherboards can have a pair of X1900s, a PCI-E TV tuner, X-Fi, and PhysX card installed at the same time like this board can.

Like the P5B Deluxe WiFi-AP Edition, the P5W DH Deluxe has a very complete system BIOS designed for overclockers and performance enthusiasts. You can alter the FSB frequency in 1MHz increments and

	Asus P5N32-SLI SE	Asus P5B Deluxe WiFi-AP Edition	Intel D975XBX Rev. 2	Asus P5W DH Deluxe	Nvidia nForce 590 SLI Intel Edition
SiSoftware Sandra 2007 Pro					
Processor Arithmetic					
Dhrystone ALU	24,527Mips	24,863Mips	24,677Mips	24,975Mips	24,654Mips
Whetstone iSSE3	16,856MFlops	16,920MFlops	16,896MFlops	17,044MFlops	16,882MFlops
Processor Multimedia					
Integer x4 aEMMX/aSSE	144,814itps	145,649itps	145,018itps	146,114itps	144,736itps
Floating-point x4 iSSE2	78,2685itps	78,947itps	78,755itps	79,151itps	78,243itps
Memory Bandwidth					
Integer Buffered iSSE2	5,819MBps	5,686MBps	5,643MBps	5,691MBps	5,802MBps
Floating-point Buffered iSSE2	5,804MBps	5,684MBps	5,643MBps	5,688MBps	5,796MBps
PCMark05					
CPU	7,491	7,521	7,453	7,469	7,503
Memory	6,058	5,927	5,966	6,027	5,925
LAME MT MP3 Encoding (minutes:seconds)					
Single-threaded	0:47	0:47	0:47	0:47	0:47
Multithreaded	0:31	0:31	0:32	0:31	0:31
Cinebench 2003 (seconds)					
Single-threaded	52	51.9	51.8	51.6	51.7
Multithreaded	28	28	28.4	27.9	28
Kribibench v1.1					
Sponge Explode Model	6.43fps	6.22fps	6.14fps	6.19fps	6.11fps
Ultra Model	2.01fps	1.99fps	1.97fps	1.99fps	1.98fps
Application Benchmarks					
Nero Burning ROM (seconds)	462	421	430	426	465
3ds MAX (seconds)	185	188	188	187	187
Office XP SP2 (seconds)	481	480	475	474	484
Photoshop 7 (seconds)	207	204	205	204	206
F.E.A.R. v1.05 640 x 480 low quality	268fps	264fps	272fps	274fps	251fps
Quake 4 v1.2 (SMP enabled) 640 x 480, low quality	201.9fps	212.6fps	203.5fps	208.6fps	199.3fps

configure the RAM clock as high as 1,066MHz without having to overclock the processor. There are multiple other tweakable voltages available, including CPU vCore and vDIMM.

This board's accessory bundle is so complete we have to break down the list into sections. For documentation, the retail package includes a very complete user guide, manuals for the integrated Wi-Fi controller and DH Remote, and several pamphlets outlining the board's more interesting features. There's also a driver CD and Media Launcher CD, and you also get four SATA cables, two Molex-to-SATA power adapters, a floppy cable, and 80-wire and 40-wire IDE cables. You also get an optional VRM fan, I/O shield, case badge, Wi-Fi antenna, and three case brackets. One bracket has one FireWire connector, another a pair of USB ports, and a third one a 1/8-inch audio input dubbed MP3 In. Using the MP3 In bracket, you can connect any MP3 player with a standard headphone jack to the P5H DH Deluxe and use the PC speakers even when the system is off. The included DH Remote lets you power the system on and off and control various aspects of the Wi-Fi controller and multimedia apps.

The P5W DH Deluxe's I/O backplane is identical to the P5B Deluxe WiFi-AP Edition's, with PS/2 mouse and keyboard ports; one serial, eSATA and FireWire port; coaxial and optical SPDIF outputs; six 1/8-inch audio inputs and outputs; four USB 2.0 ports; two LAN jacks; and a connector for the integrated Wi-Fi controller's external antenna.

This motherboard's extensive feature set and excellent performance are bound to make it a popular choice among performance enthusiasts. We just hope the price drops a bit once Core 2 processor availability ramps up. ▲

by Marco Chiappetta

DDR2 & The Core 2 Extreme: New CPU, Same Memory Controllers

Last month (page 62), we tested five DDR2 memory kits from Kingston, OCZ, and Corsair using AMD's Socket AM2 platform. Despite having varied specifications, each kit we tested performed similarly in a sampling of real-world benchmarks. Synthetic benchmarks clearly illustrated the effects that clock speeds and timings had on overall bandwidth and access latency, but in gaming benchmarks, only a few frames per second separated the various configurations.

Now that Intel has unleashed its Core 2 Duo and Core 2 Extreme processors, it's time to update last issue's DDR2 roundup with scores and analysis for the same five kits for the Intel platform. Keep in mind that unlike AM2 processors, Core 2 Duo and Extreme don't have a new memory controller. Instead, they interface with system memory via a motherboard chipset. Additionally, although the Core 2 Duo and Extreme are based on a new microarchitecture, the CPUs are compatible with the same chipsets and memory controllers used with Pentium D processors. Some motherboards will need to be reworked to be made compatible, but not the chipsets.

Higher Clock Speeds Or Lower Latency?

We wanted to know which would result in better DDR2 memory performance with a Core 2 Extreme: increasing clock speeds or running low-latency modules at lower-clock speeds? The following charts show benchmark scores at various settings with a 2.93GHz Core 2 Extreme X6800 installed in an Asus P5N32-SLI SE motherboard based on Nvidia's nForce 4 SLI x16 chipset.

To run the memory at various CAS latencies, we altered the timings manually in the system BIOS. For the various clock speed tests, we used a combination of multiplier and FSB frequency manipulation and memory divisor manipulation to attain the different speeds. Doing this we kept the CPU running at its default 2.93GHz clock speed while clocking the memory differently.

Our results indicate that clock speeds have a larger impact on performance than lower latencies with the Core 2 Extreme—the same conclusion we came to with AM2. Another interesting comparison among the synthetic and real-world tests on the two platforms shows AMD's integrated memory controller lets the Athlon 64 FX-62 get much closer to its peak theoretical bandwidth than Intel's. However, despite having a fraction of the amount of bandwidth available to AMD's CPU, the Core 2 Duo Extreme X6800 significantly outpaces the Athlon 64 FX-62 in the gaming tests.

DDR2 Memory Performance: Corsair vs. Kingston vs. OCZ

Despite the differences in clock speeds and timings, there was surprisingly little variance in our real-world gaming benchmarks among the five memory kits we tested from the three companies. The platforms performed differently, but there was little variation between the modules on the same platform. The DDR2-1,000 and 1,066MHz modules offered the largest amount of bandwidth, but the kits with tighter memory timings and lower clock speeds performed just as well, if not better than, the higher-clocked, higher-latency modules depending on the benchmark.

A month removed from our AM2 memory roundup, the DDR2-1,000 and DDR2-1,066 modules still command a substantial price premium over DDR2-800 modules, even the high-end 800MHz

DDR Memory Performance Chart

	Corsair XMS2 8500C5 1,066MHZ 5-5-5-18-2T		Corsair XMS2 6400C4 800MHz 4-4-4-12-2T		Kingston HyperX KHX 6400 800MHz 4-4-4-12-1T		OCZ PC2-8000 Platinum EL 1,000MHz 5-5-5-15-2T		OCZ PC2-8000 Gold GX XTC 1,000MHz 5-6-6-15-2T	
	Core 2 Extreme X6800	**Athlon 64 FX-62**	**Core 2 Extreme X6800**	**Athlon 64 FX-62**	**Core 2 Extreme X6800**	**Athlon 64 FX-62**	**Core 2 Extreme X6800**	**Athlon 64 FX-62**	**Core 2 Extreme X6800**	**Athlon 64 FX-62**
SiSoftware Sandra 2007 Memory Bandwidth	7,298 MBps	10,132 MBps	5,595 MBps	8,989 MBps	5,673 MBps	9,349 MBps	7,254 MBps	10,102 MBps	7,108 MBps	9,892 MBps
SiSoftware Sandra 2007 Memory Latency	68ns	74ns	81ns	81ns	81ns	81ns	67ns	74ns	70ns	78ns
Sciencemark 2.0 Memory Bandwidth	6,914 MBps	9,073 MBps	5,242 MBps	8,541 MBps	5,29 MBps	8,623 MBps	6,771 MBps	8,870 MBps	6,734 MBps	8,812 MBps
Sciencemark 2.0 Memory Latency	37.84ns	40.2ns	47.39ns	43ns	46.17ns	41.1ns	38.52ns	40.6ns	40.22ns	41.4ns
Half-Life 2: Episode One 1,024 x 768 no AA/AF	136.41fps	119.2fps	131.63fps	121.08fps	132.64fps	122.3fps	135.74fps	122.31fps	133.59fps	120.8fps
F.E.A.R. 1,024 x 768 low quality no AA/AF	205fps	167fps	197fps	171fps	199fps	170fps	204fps	167fps	200fps	165fps

modules with low-latency timings. Given the similar performance at stock settings, we'd still recommend purchasing high-quality DDR2-800 modules with low latencies at this point. Not only will performance levels be nearly identical to those clocked at DDR2-1,066, but you won't have to risk instability by running at overclocked speeds. If overclocking is your main goal, however, spring for a DDR2-1,000 or DDR2-1,066 kit for added flexibility.

On the Intel platform, the Kingston modules provided the best stock 800MHz performance. The kit also has the lowest price, so they remain our recommendation for most users. Corsair's XMS2 6400C4 modules are also a good buy; they have a lower price compared to the 1,000MHz-plus modules but can also overclock to higher levels if you're willing to live with some latency. OCZ's modules are excellent performers and overclockers, but they're priced higher than the other kits here. ▲

DDR2 At Various CAS Settings & 800MHz Clock Speed

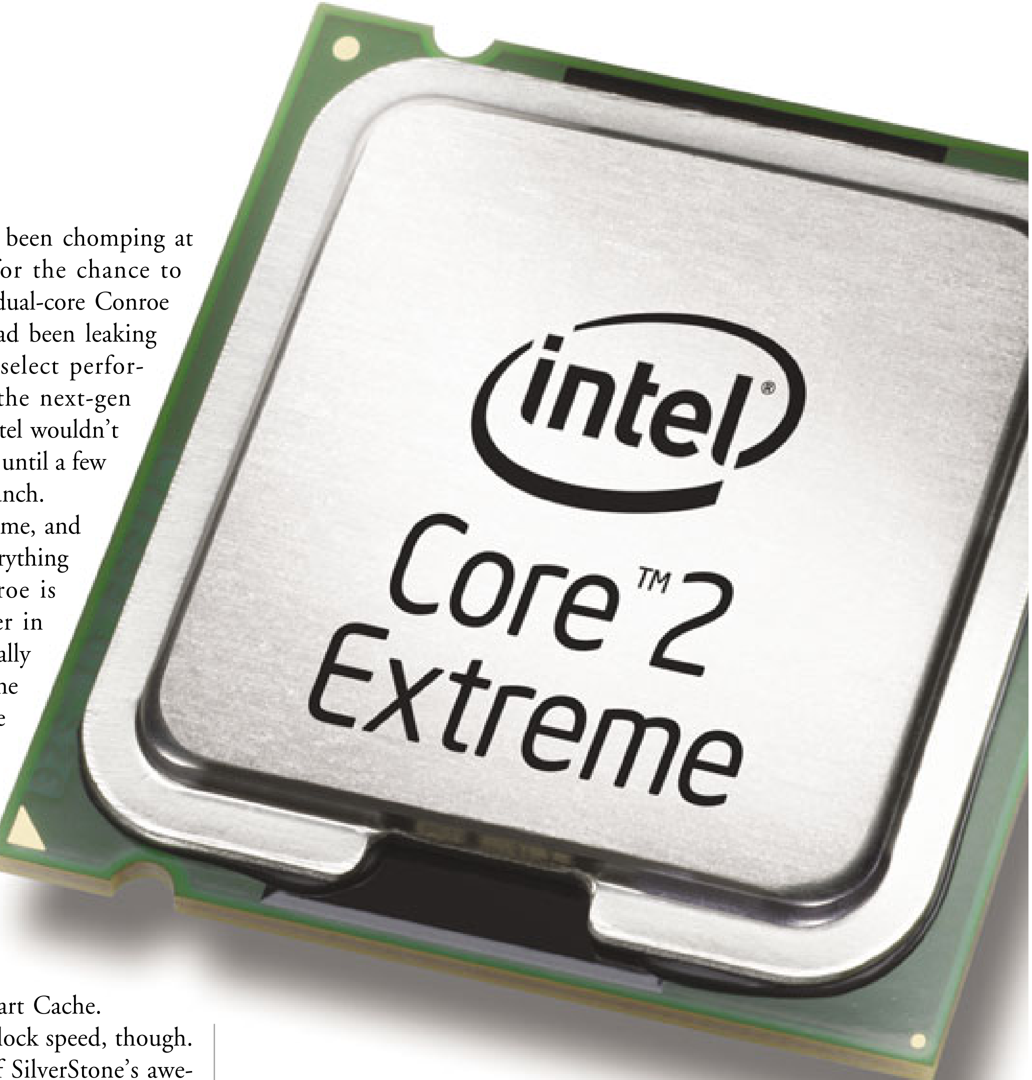
	CAS 6-6-6-2T		CAS 5-5-5-2T		CAS 4-4-4-2T		CAS 4-4-4-1T		CAS 3-4-4-2T	
	Core 2 Extreme X6800	Athlon 64 FX-62	Core 2 Extreme X6800	Athlon 64 FX-62	Core 2 Extreme X6800	Athlon 64 FX-62	Core 2 Extreme X6800	Athlon 64 FX-62	Core 2 Extreme X6800	Athlon 64 FX-62
SiSoftware Sandra 2007 Memory Bandwidth	5,498 MBps	8,397 MBps	5,632 MBps	8,715 MBps	5,669 MBps	9,004 MBps	5,806 MBps	9,413 MBps	5,701 MBps	9,581 MBps
SiSoftware Sandra 2007 Memory Latency	84ns	88ns	79ns	85ns	75ns	82ns	71ns	81ns	72ns	77ns
Sciencemark 2.0 Memory Bandwidth	5,142 MBps	7,126M MBps	5,237 MBps	7,772 MBps	5,334 MBps	8,168 MBps	5,271 MBps	8,645 MBps	5,322 MBps	8,861 MBps
Sciencemark 2.0 Memory Latency	46.7ns	48.7ns	45.68ns	45.5ns	42.95ns	43ns	41.93ns	42.3ns	42.27ns	39.8ns
Half-Life 2: Episode One 1,024 x 768 no AA/AF	129.14 fps	114.9 fps	131.26 fps	117.5 fps	132.69 fps	121.3 fps	136.04 fps	122.7 fps	133.12 fps	124.2 fps
F.E.A.R. 1,024 x 768 low quality no AA/AF	198fps	163fps	200fps	168fps	202fps	170fps	206fps	171fps	204fps	174fps

DDR2 At Various Clock Speeds With 5-5-5-2T Timings

	DDR2-533		DDR2-667		DDR2-800		DDR2-1,066	
	Core 2 Extreme X6800	Athlon 64 FX-62	Core 2 Extreme X6800	Athlon 64 FX-62	Core 2 Extreme X6800	Athlon 64 FX-62	Core 2 Extreme X6800	Athlon 64 FX-62
SiSoftware Sandra 2007 Memory Bandwidth	4,924MBps	5,578MBps	5,323MBps	6,765MBps	5,632MBps	8,715MBps	7,314MBps	10,664MBps
SiSoftware Sandra 2007 Memory Latency	104ns	102ns	91ns	97ns	79ns	85ns	67ns	70ns
Sciencemark 2.0 Memory Bandwidth	4,671MBps	5,673MBps	4,985MBps	6,385MBps	5,237MBps	7,772MBps	6,923MBps	9,498MBps
Sciencemark 2.0 Memory Latency	57.96ns	66.84ns	51.48ns	55.1ns	45.68ns	45.5ns	37.57ns	38.5ns
Half-Life 2: Episode One 1,024 x 768 no AA/AF	122.09fps	101.3fps	126.72fps	108.6fps	131.26fps	117.5fps	137.34fps	125.6fps
F.E.A.R. 1,024 x 768 low quality no AA/AF	188fps	147fps	198fps	157fps	200fps	168fps	206fps	173fps

CPU's Core 2 "Extreme Machine"

Making The Fastest Even Faster



For months, we've been chomping at the bit waiting for the chance to evaluate an Intel dual-core Conroe processor. Intel had been leaking information and select performance data regarding the next-gen CPU for months, but Intel wouldn't seed analysts with samples until a few weeks before the official launch.

Well, that launch has come, and the Core 2 Duo and Core 2 Extreme are everything that Intel promised they would be. Conroe is wicked-fast, and it seemingly sips at power in comparison to the Pentium D. When we finally got our hands on the flagship Core 2 Extreme X6800, we had to put together a system to see what it could really do.

Cool Down

We had one goal when we began this project: build the fastest Intel-powered rig possible. With that in mind, we started with the Core 2 Extreme X6800 ($999). The X6800's default clock frequency is 2.93GHz, and it has 4MB of Smart Cache. We planned to push it well past its default clock speed, though. To keep the X6800 cool, we snagged one of SilverStone's awesome Nitrogen NT06 ($55) coolers. The combination worked quite well, as we were able to overclock the CPU to a tasty 3.55GHz, and the NT06's oversized footprint and fan provided the chipset and VRM heatsinks around the CPU socket with plenty of air circulation.

Powering our Extreme Machine is Intel's new flagship desktop processor, the Core 2 Extreme X6800. The processor's stock 2.93GHz clock speed wasn't enough for us, though. The 3.5GHz-plus speed we hit overclocking the chip will do, however.

An nForce Motherboard?

We faced an interesting dilemma in choosing a motherboard for our Extreme Machine. As the saying goes, “No one ever got fired for buying Intel,” and coupling an Intel CPU with a board based on an Intel chipset almost always guarantees a solid experience. But our goal was to build a powerful overall system, meaning it would have a pair of graphics cards. We could have gone with an Intel 975X Express-powered mobo and installed two Radeon X1900 XT cards in a CrossFire config, but as far as multiple-GPU setups go, Nvidia’s SLI is where it is at. SLI has had more time to mature, performance typically scales better with SLI in most games, and there’s no clunky dongle to contend with. CrossFire is good, but SLI is better at this point.

This meant we had to select a board based on an Nvidia nForce SLI chipset. As of this writing, there are no solid, retail-ready nForce 590 SLI Intel Edition boards available (we did have a reference board on hand), so we went with the next best thing in the nForce4 SLI x16. The P5N32-SLI SE (about $180) is Asus’ second go-round with the nForce4 SLI x16 chipset. Asus ironed out a few wrinkles that affected Rev. 1 of the P5N32-SLI, and in our testing, this motherboard was faster than our reference nForce 590 SLI board. The P5N32-SLI is also an adept overclocker—another major plus.

Lower The Latency

You can’t have a high-performance rig without overclockable, low-latency memory. Quality memory is also a key component in building a stable system. We enlisted Corsair’s help for our Core 2-powered Extreme Machine, installing a TWIN2X2048-6400C3 kit ($453), which includes a matched pair of XMS 1GB DIMMs (2GB total). The memory can operate at low latencies of 3-4-3-9 at a speedy 800MHz with a 2.1V feed.

To keep our new Core 2 Extreme X6800 processor nice and chilly (even while overclocked), we used a beefy SilverStone Nitrogen NT06 cooler. (See page 17 for our review of this cooler and others.)

Corsair’s TWIN2X2048-6400C3 2GB DDR2 memory kit makes an encore appearance this month in our Extreme Machine build. This memory kit’s high capacity and low latencies of 3-4-3-9 make it a great choice for a high-end system.

Considering how powerful this system is, we thought our Extreme Machine rig should have a menacing look, so we crammed all our components into the monolithic Cooler Master CM Stacker 830.

With a slight bump in voltage and a CAS 4 setting, the memory can usually hit much higher frequencies. (We've taken this memory well over 1GHz on a few occasions.)

48 Pipes Of Graphical Goodness

To push the pixels in our machine, we installed two 512MB Nvidia GeForce 7900 GTX cards ($499 x 2) to run in an SLI multi-GPU configuration. We contemplated using two 7950 GX2 cards for some quad-SLI action, but until Nvidia officially blesses quad-SLI in the DIY segment and until we're outfitted with some 30-inch panels, it's 7900 GTXs for now. To further bolster performance, however, we overclocked the 7900 GTXs, too. After some tweaking, the cards ran with reliable GPU and memory clock speeds of 700MHz and 875MHz (1.75GHz DDR), respectively. For those keeping track, that's a 50MHz boost for the GPU and a 150MHz jump for the memory.

Lightning-Quick Drives

Western Digital's 10,000rpm WD1500 hard drives have stood alone at the top of the desktop hard drive performance charts since their introduction months back. Based on the Raptor WD1500's consistently dominant performance, we dropped two ($289 x 2) into our Extreme Machine running in a striped RAID 0 config. We know 300GB isn't much by today's storage standards, but you can't beat the performance that a pair of Raptors running in RAID 0 provides—unless you link more than two of the drives together. And if we need more storage later, we can always plunk one of Seagate's 750GB monsters in the rig.

Power & The Rest

Like the Ultimate AM2 rig we built last month (page 68), the rest of our Extreme Machine's components included an OCZ GameXstream 700W SLI-certified PSU ($160), Sound Blaster X-Fi sound card ($115), and Plextor PX-716A ($145) burner. We did switch cases with this rig, though. We want to really turn heads with this Extreme Machine, so we housed our system in a Cooler Master CM Stacker 830 ($240).

The result of our efforts is a supremely powerful system that tore through all our benchmarks, and our components let us overclock the Core 2 Extreme X6800 CPU to over 3.5GHz, with the RAM running at over 1GHz. ▲

by Marco Chiappetta

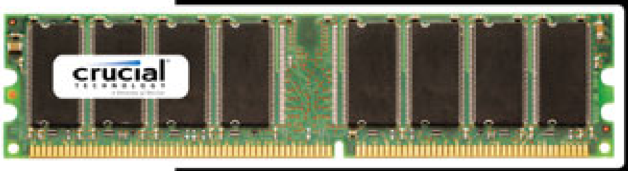
Ultimate Core 2 Extreme Machine Performance Profile

With our Extreme Machine assembled, we did some benchmarking to see how our new baby could perform. We ran a complete set of numbers with the machine in its default configuration to get a baseline for performance, but we're not the types to settle for stock performance. To wring the most performance from the rig, we overclocked the processor, memory, and graphics cards to make what was an already fast rig even faster.

We overclocked the Core 2 Extreme X6800 by bumping up its voltage to 1.425V and increasing the FSB frequency until the system no longer ran stably. We backed down the FSB until we found a sweet spot of 322MHz, which resulted in a 3.55GHz CPU speed. We cranked the memory voltage to 2.25V and relaxed the timings a bit until we peaked at a cool 1GHz DDR. We overclocked the graphics cards by enabling CoolBits in Nvidia's drivers. The system ran on Windows XP Pro SP2, with DirectX 9.0C (June 2006 update), Nvidia's ForceWare v91.33, and nForce v6.86 drivers.

We'll let the numbers speak for themselves. We'll just say that this is far and away the fastest rig we've ever built. We said that last month, too, in regard to our Ultimate AM2 Rig, but there's no comparison to this Extreme Machine. In all but Sandra's Memory Bandwidth test, the Extreme Machine dominates the Ultimate AM2 Rig. ▲

	Stock Clock Speeds Core 2 Extreme X6800 at 2.93GHz	Overclocked Speeds Core 2 Extreme X6800 at 3.55GHz
SiSoftware Sandra 2007 Pro		
Processor Arithmetic		
Dhrystone ALU	27,051Mips	32,488Mips
Whetstone iSSE3	18,712Mips	22,810Mips
Processor Multimedia		
Integer x4 aEMMX/aSSE	160,644itps	193,335itps
Floating-point x4 iSSE2	87,212itps	105,439itps
Memory Bandwidth		
Integer Buffered iSSE2	5,702MBps	7,270MBps
Floating-point Buffered iSSE2	5,776MBps	7,254MBps
LAME MT MP3 Encoding (minutes:seconds)		
Single-threaded	0:47	0:39
Multithreaded	0:31	0:26
Cinebench 2003 (seconds)		
Single-threaded	51.6	43.5
Multithreaded	27.9	23.4
F.E.A.R. v1.05		
Low-res CPU Test (640 x 480 low quality)	251fps	288fps
High-res Graphics Test (1,600 x 1,200 4XAA/16XAF)	94fps	107fps



MEMORY MYSTERY
SOLVED,CASE CLOSED.

System Scanner Report
Your computer currently has 1024MB of memory; and supports up to 2048MB. You have an AGP graphics card.

Slot 1: 1024MB Non-parity; DDR2 PC2-5300

Slot 2: EMPTY

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www.crucial.com/cpu

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So how are you supposed to know which upgrade to buy? Don't spend hours tracking down the right memory — let the Crucial System Scanner take the guesswork out of upgrading! In just one click, our System Scanner tool analyzes your PC's configuration, then automatically recommends the exact upgrades for your system.

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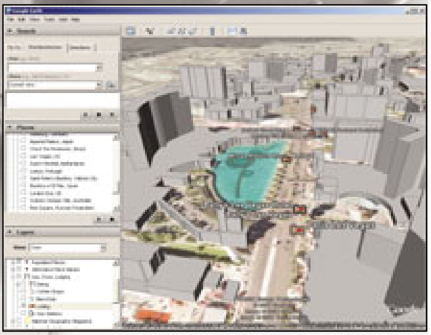
by Warren Ernst

The Bleeding Edge Of Software

Inside The World Of Betas



Official product name: Google Earth
Version # previewed: 4.0 Beta
Publisher: Google
Developer and URL: Google; earth.google.com
ETA: Q3 2006
Why you should care: Only Google can make geography interesting to the masses.

Google Earth 4.0 Beta

Who would have thought a search engine could make surfing the globe as easy and fun as surfing the Web? Google Earth, a program compelling enough for news organizations to use during broadcasts, wasn't initially without its share of problems and UI tricks, but the latest beta goes a long way to making the app more accessible and easy to use.

GE is a digital globe you can rotate and zoom in on down to street level. On-screen switches let you see satellite images, conventional roadmaps, and POI (points of interest) individually or overlaid on each other. As with Google Maps, you can get directions to and from almost any location and mark POI for later. Naturally, GE requires a Web connection to download geographical data, and the faster the connection, the faster you see what you want.

GE's wow factor has always been high, but the UI had been clunky and saddled with unintuitive buttons and navigational commands. This beta replaces those with a trio of navigation widgets that magically appear and disappear as you roll your mouse over the upper-right corner. Scrolling in any direction is as easy as dragging a joystick nub around the screen. You can also easily change directional views, the tilt, and zoom, although zooming using a mouse's scroll wheel soon becomes second nature.

Sharing data (3D models, paths, POI) with others is now possible thanks to an extension of the KML file format, and entire online tourist groups have formed around the expanded abilities. When loaded, 3D buildings can have textures, so models look like actual buildings, or you can overlay scanned maps over a 3D geographic texture. The possibilities seem infinite.

A $20 Plus version adds GPS integration and greater data import/export abilities, but the free version is really more than enough to explore the world like never before. Versions are available for Linux, Mac, and Windows. ▲

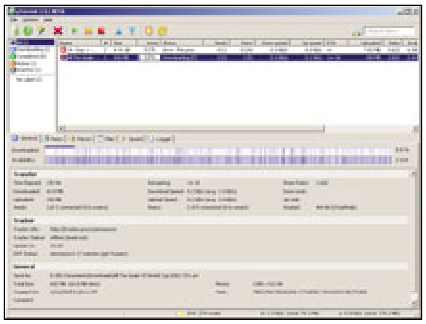
uTorrent 1.6 Beta 467 RCI

Where many segments of the software market are producing versions of apps that are evermore bloated, many BitTorrent clients are getting smaller. For example, uTorrent, with just a 170KB executable, gives up almost no functionality to any of its larger cousins.

Like many BT clients, uTorrent displays torrents in a main pane and details for a selected torrent below. If many torrents are going at once, a filter pane to the left displays only those you want data for. uTorrent isn't stingy when doling out torrent data, however, and you may need to look up what some details actually mean.

New are uTorrent's RSS reading abilities. Although still a little crude (you must construct a valid RSS feed string, such as http://sometorrentsite.com/rss.php:COOKIE:uid=1234;pass=asdjh12378912y3lkj), when you set it up properly, uTorrent can scan RSS feeds that video-distribution sites release, determine when a new torrent matching your search flags is created, and start downloads automatically. With a little trial and error, you can come home to downloaded content that's ready to play.

The beta works about how you'd expect, but perhaps with some unexpected config options. The online FAQ is huge and covers various tweaks for your system and ways to get uTorrent working on different networks and through various firewalls. Given its free price, you'd be crazy not to check it out. ▲



Official product name: uTorrent
Version # previewed: 1.6 Beta 467 RC1
Publisher: Ludvig Strigeus
Developer and URL: Ludvig Strigeus; www.utorrent.com
ETA: Q3 2006
Why you should care: Possibly the lightest BitTorrent client available with this many features.

UP TO SPEED

Upgrades That'll Keep You Humming Along

Some of our favorite everyday tools get refreshes, including Microsoft's never-ending IE 7 Beta program, the Flash Player, Google Desktop, and a video re-encoder for ATI's Catalyst driver. Also check out changes in the innovative Opera 9.

Upgrades

Adobe Flash Player 9

Adobe says we'll now see faster program loading and improved rendering performance via a new ActionScript 3.0 engine, which also promises new dynamic video effects for Flash programmers.

Get it at: www.adobe.com

AI RoboForm 6.7.4

The form-filler/password vault improves protection against keyloggers, speeds up performance in how passwords are stored, and makes corrections to now work properly with the Yahoo! Toolbar.

Get it at: www.roboform.com

FileZilla 2.2.25

The FTP client fixes a crash in the speed-limit code, a problem involving connections using SSL in custom port ranges, and how the quickconnect bar handles certain URLs.

Get it at: filezilla.sourceforge.net

Google Desktop 4.2006.623.2309

This version of the Desktop search client is now compatible with Google's own Gadgets, adds performance tweaks, and lets you remove deleted files from the search cache.

Get it at: www.google.com

HyperSnap-DX 6.10.00

This version of the screen grabber adds a TextSnap menu item and new text-capture functionality and compatibility.

Get it at: www.hypersnap-dx.com

Internet Explorer 7 Beta 3

This beta version lets you drag and drop tabs to reorder them, scroll horizontally while zooming, update all RSS feeds at once, and more.

Get it at: www.microsoft.com

OpenOffice.org for Windows 2.0.3

Improvements for the open-source office suite include up to 23% faster Calc speeds and improved file-format compatibility with Microsoft Office files. You can also send email in Microsoft file formats.

Get it at: www.openoffice.org

Opera for Windows 9 Build 8502

Opera 9 is official, but this build adds a content blocker and new search engine editor, improves widgets, and adds tweaks to built-in BitTorrent features.

Get it at: www.opera.com

RyanVM's Windows XP Post-SP2 Update Pack 2.0.7a

This special-purpose pack for updating a WinXP SP2 CD and the latest Microsoft hot fixes adds recent WinXP updates.

Get it at: www.ryanvm.net/msfn

Skype 2.5.0.122

This upgrade updates foreign language interfaces and installation; adds a Send SMS command to the toolbar; and addresses bugs involving system crashes when hanging up, Web cam issues, and language handling.

Get it at: www.skype.com

Skype For Linux 1.3.0.30 Beta

This Skype version for Linux adds ALSA (Advanced Linux Sound Architecture) support, new sounds dialog, a Getting Started Wizard, easier contact adding, and updated emoticons.

Get it at: www.skype.com

Winamp 5.24

Recent updates to the media player fix a crash bug and potential security hole and add numerous fixes involving CD burning, Media Library preferences, and playlist saving with network share files.

Get it at: www.winamp.com

WINAMP
File Play Options View Help
00:00
A LITTLE HELP FROM MY FRIENDS
EQUALIZER OPTIONS COLOR THEMES

XP-AntiSpy 3.96-2

This tool for closing security holes fixes a bug in handling connection limits.

Get it at: www.xp-antispy.org

Driver Bay

ATI Catalyst 6.6

New in this package is a Windows Media Center Edition Video Conversion utility that lets you re-encode MCE video into multiple formats, including MPEG-2/4 and iPod-/PSP-compatible files. There are also performance improvements for Far Cry, F.E.A.R., and Splinter Cell.

Get it at: www.ati.com

Nvidia ForceWare 91.31

This version has new GeForce drivers that add support for the 7950 GX2. There's also a new Nvidia Control Panel and new PureVideo features for noise reduction and image sharpening, better rendering algorithms, and compatibility with third-party MPEG-2 decoders.

Get it at: www.nvidia.com

Zen Vision M Firmware 1.41.01

Support for Audible audio books Type 2 and 4 formats is added, while fixes include proper playback of slides and audio, accurate time display after resuming, and better playback resuming on subscription/purchased tracks.

Get it at: www.creative.com

by Steve Smith

Video Encoder Roundup

Five Programs For Your File-Conversion Needs

Video encoders convert video files from one format to another, often compressing the converted file in the process. As you probably know, compressing video means using a video codec, which is really nothing more than an algorithm that compresses (and decompresses) a video file. For the uninitiated, video codecs typically use lossy compression to compress video by removing parts of the video in much the same way MP3 files compress audio files by removing sounds that the listener won't notice missing.

The trick behind a codec is it knowing which parts of a video to remove without degrading the overall quality. At the simplest level, a codec only saves images that change from one frame to the next. If a background is identical throughout multiple frames, a codec may only store the background once from a single frame, thus reducing the video's size considerably.

Besides eliminating redundant images, codecs use such other methods as reducing the number of colors saved, altering the video's frame rate, and lowering the audio quality. Reducing colors involves eliminating those colors a user won't noticeably miss, while lowering audio quality involves eliminating sounds that the human ear can't hear anyway.

Video Optimization

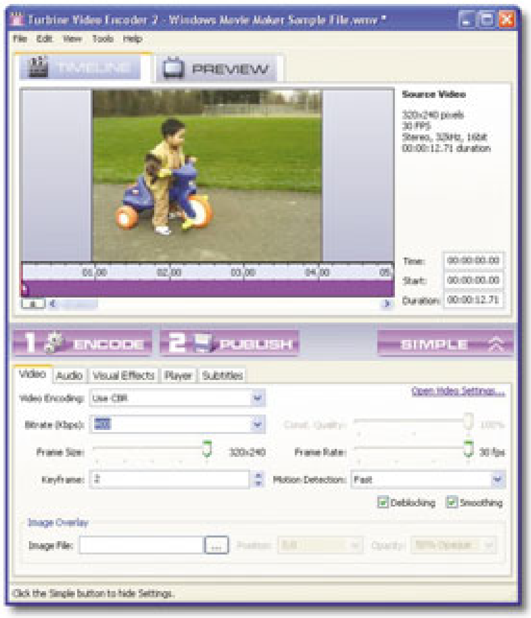
The default settings of many video encoders may be sufficient for casual users, but they won't always convert files with the highest video quality or the smallest file size. To get optimum results, it helps to understand what an encoder's settings do and how they affect the overall quality of converted files.

Perhaps the simplest way to optimize a video file is leaving the file untouched but modifying the file's audio portion instead. For example, when converting a video to an AVI file, most apps have an option to store the video's audio as MP3, PCM (pulse code modulation), ADPCM (adaptive PCM), A-Law, u-Law, or GSM (Global System for Mobile communications) data. Basically, these methods compress audio by stripping away chunks of sound you won't notice are missing. MP3 is the common file-swapping standard, but PCM is widely used for compressing audio on CDs and GSM for compressing audio in cellular phones.

To further compress audio, you can specify an audio bit rate and the number of channels to use to play sound. The bit rate can anywhere from 32 to 320Kbps (128Kbps is considered minimally acceptable to retain audio quality), while the number of channels can be one (monaural), two (stereo), or five (surround sound). The lower the bit rate and number of channels, the lower the sound quality. If your video includes mostly voice narration as opposed to music, you can often reduce the bit rate from 128 to 96Kbps and the number of channels from five or two to one with minimal loss of audio quality.

To optimize video quality, you can usually adjust the frame size and frame rate. The frame size defines the physical dimensions of the video. The smaller the frame size, the sharper the video quality, as flaws aren't as easily seen. Frame rate defines how many frames per second are used to capture video. The higher the frame rate, the better the video quality. Frame rates typically vary between 10 to 30fps. The more frames there are the smoother the video will be but the more storage space will be required. Not all frame rates are equal, however. Some video encoders give you the option of 30fps interlaced or 30fps progressive. These options define how the video will play back.

A progressive video displays images by drawing them line by line starting from the top of a screen to the bottom. An interlaced video displays that same image but skips every other line. First, it may draw odd-numbered lines and then draw even-numbered lines. Given identical videos that use the same frame rate, a progressive video will appear sharper while interlaced video may display flickering. For higher video quality, use progressive. For smaller file sizes, use interlaced.



Source Video
320x240 pixels
30 FPS
Stereo, 32kHz, 16bit
00:00:12.71 duration

Time: 00:00:00.00
Start: 00:00:00.00
Duration: 00:00:12.71

Video Encoding: Use CBR
Frame Size: 320x240
Frame Rate: 30 fps
Keyframe: 2
Motion Detection: Fast
☑ Deblocking ☑ Smoothing

Click the Simple button to hide Settings.

Turbine Video Encoder 2
$59
Blue Pacific Software
www.blue-pacific.com
●●◐

It's also worth experimenting with various, older video codecs—such as Indeo, Cinepak, or Microsoft Video—to see how algorithms compress video differently. It's possible that one codec that works beautifully for one video type (such as people sitting on a beach) is horrible for another type (such as race cars zooming around a track).

Typically, you can also configure how a particular codec analyzes a video. Three common choices are CBR (constant bit rate), 1-VBR (1-pass variable bit rate), and 2-VBR (2-pass). CBR allows for fast encoding by treating every frame in a video equally. The drawback is sacrificing video quality because a simple frame, such as a full moon against a dark background, is treated the same as a more complicated image, such as a parade of cheerleaders tossing four-color batons in the air. 1-VBR analyzes each frame and varies the method used to encode the video. So, a simple image is treated differently than a more colorful, complicated one. For optimum quality at the expense of encoding speed, 2-VBR analyzes a video twice to look for additional ways to compress the file.

To optimize the video playback, you may have an interleaving option, meaning that when you play a video, a chunk of it (such as one or two frames) is loaded in memory and then the corresponding audio is loaded in memory. Both the video and audio play while the computer repeats the process with a new chunk of video and audio over and over again. Without interleaving video playback requires the computer to waste time loading the entire video and audio portions of a file into memory and then play them simultaneously. For small files the delay may not be noticeable, but for larger files, the delay can be annoying.

Squeezing the maximum video quality into the smallest amount of file space is less of an exact science than trial and error, but once you understand what different encoding settings do, you'll have a better idea how to use them to maximize your own video files.

How We Tested

I pulled together five video-encoding apps and tested them on a 3GHz Athlon 64 rig running Windows XP. The PC had 1GB of RAM, a 120GB hard drive, and a 128MB Nvidia GeForce FX 5200 card. To convert files I used each program's default settings, with the exception of encoding AVI files, for which I used the Indeo codec for consistency among all the apps. For testing I used a sample 360KB video file in Windows, a 162MB MPEG-1 file, and a 2MB QuickTime file and encoded them to AVI, MPEG, and WMV files.

I measured how long each app took to encode the files and then made sure the converted video would actually play. When playing the converted video, I looked for obvious signs of video degradation, such as chunkier images, skipped frames, garbled audio, or other noticeable changes from the original video. Additionally, I looked at each app's user interface from the point of view of both a novice and a more experienced user. For example, I judged whether a novice could use the app without having any knowledge of a program's various settings and if more knowledgeable users could easily tweak settings to optimize the conversion process.

Because video encoding can be such a processor-intensive task, video encoding definitely isn't a job for slower machines. At a minimum consider having a 1GHz CPU, 512MB of RAM, 30GB of free drive space, a video card, and monitor that can display at least a 1,024 x 768 resolution, and either Win2000/XP for greater reliability. (Blaze Media Pro is the only app here that can run under Win98/ME.) Obviously, you'll need a CD/DVD burner to create your own CD/DVDs. A more optimal configuration would be a 2GHz 64-bit or dual-core CPU, 2GB of RAM, a modern video card with at least 128MB of RAM, and a 100GB or larger drive (preferably SATA) rated at least at 7,200rpm.

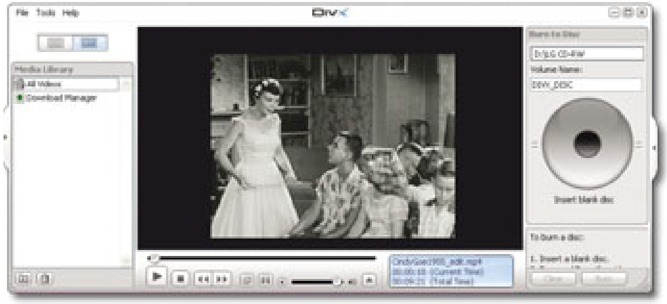
Blue Pacific Software
Turbine Video Encoder 2

Turbine Video Encoder only converts video to the Flash format, which can be useful for storing video on Web pages or playing files on any computer that has the free Flash player installed. To help beginners, the program has Simple and Advanced modes. The Simple mode lets you load a video file, encode it to a Flash video, and publish it. The Advanced mode lets you choose different optimization settings, such as a choice between CBR or 2-pass VBR compression or adjusting the bit rate from 56 to 1,500Kbps.

Besides encoding different video formats to Flash, the app also offers various visual effects, such as tiling multiple images across the screen, along with the ability to add subtitles to video frames. Encoding videos to Flash makes it easy to distribute videos to others, but the format doesn't necessarily create the highest-quality videos. With every test file I tried, the program created video that was noticeably chunkier than the original.

If you only need to convert short videos to Flash movies, Turbine Video Encoder does the job simply and easily. If you need to convert video to other formats, you need high-quality video resolution, or you need to convert large video files (the program took 6.5 hours to convert my 162MB test file), however, look to another program instead.

DivX Pro



DivX Pro
$19.95
DivX
www.divx.com
●●●◖

DivX Pro consists of four separate programs that work together, including DivX Player (for viewing video), DivX Web Player (for viewing video in a Web browser), DivX Codec (for compressing video), and DivX Converter (for converting video to the DivX format). DivX Player and Web Player are free, but Codec and Converter are a very reasonable $19.99 for both.

DivX Pro essentially just converts different video files to the DivX format, which the company is positioning as the video version of MP3 files. In much the same way that MP3 files revolutionized how audio is transferred, DivX seems hopeful its file format can do the same for video files.

Compressing and converting a video to DivX format involves dragging a video file to the DivX Converter program and clicking Convert. The conversion process is simple and fast; converting my 162MB video file took only a few minutes. As mentioned, Turbine Video Encoder took 6.5 hours to convert the same file. Even more impressive is that the compressed DivX version of the video retained the same resolution as the original with no noticeable loss of quality whatsoever.

DivX can also burn your video to CD. If you have a DVD that is not copy-protected, the program can squeeze and burn a DVD-length movie to a CD with no noticeable loss of video or audio quality. Given the speed that DivX can work and its high-compression rate, combined with its retention of the original video quality, the app would seem to be the perfect program. But there were a few flaws in my testing.

The biggest flaw was that the app was picky about the file types it would convert. The program converted the 162MB MPEG-1 file very quickly, but it choked on the much smaller and simpler 360KB WMV file, displaying an error message that it couldn't accept video files with variable frame rates. (DivX's support team indicated that if you encode a WMV file, you should specify a constant frame rate. That's fine if you created the video but not if you got it from another source. DivX did offer a workaround involving downloading a third-party app, but this extra step may turn some users off, especially novices.)

In addition, the Windows version of DivX wouldn't work with my QuickTime file. The company does offer a Mac OS version of DivX, however, which I was able to install and use to convert my QuickTime file, producing a 1.9MB DivX file in 17 seconds.

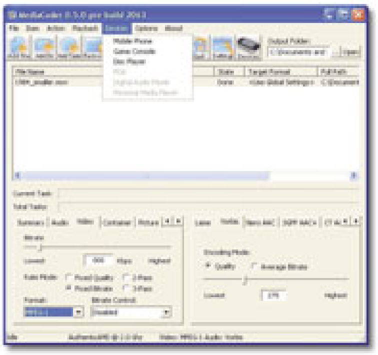
If DivX works with your video files, it will reward you with small video files compressed seemingly in a blink of an eye. If it won't work with your files, you'll have to settle for another encoder that likely won't be as fast or accurate.

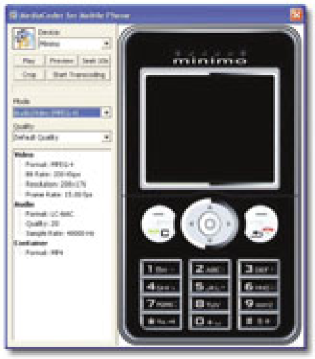
MediaCoder 0.5

Not all encoders are of the commercial variety, including the open-source MediaCoder. Despite its prerelease status, the program can work with an impressive variety of file formats, including RealVideo, QuickTime, AVI, and MPEG. Additionally, if you want to output video to a cell phone or game console, MediaCoder can display a sample image on a simulated screen to preview the video. So, by viewing the video on a simulated cell phone screen, for example, you can see whether the video will be easy to view or not.

Despite such features and its range of supported formats, this program is definitely not for casual users. The interface is cluttered and confusing, with drop-down menus and tabbed interfaces that display a bewildering array of list boxes with options that only make sense if you are already familiar with video-encoding terms. (Those who don't know the difference between XviD, H.264, or the Snow formats, for example, won't find much help within the program to explain the differences.)

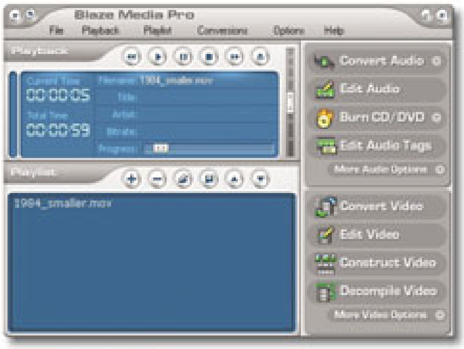
MediaCoder lets you change the interface between Simple, Normal, and Expert views, but the Simple mode just hides crucial details you may want to access (such as the format to convert to). The Normal (default) mode bombards you





MediaCoder 0.5
Free
Stanley Huang
mediacoder
.sourceforge.net
●◖

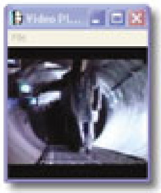
CPU RANKING ○ 0 = ABSOLUTELY WORTHLESS | ●●◖ 2.5 = ABSOLUTELY AVERAGE | ●●●●● 5 = ABSOLUTELY PERFECT



Current Time 00:00:05 Filename: 1984_smaller.mov

Total Time 00:00:59

1984_smaller.mov



Blaze Media Pro
$50
Mystik Media
www.blazemp.com
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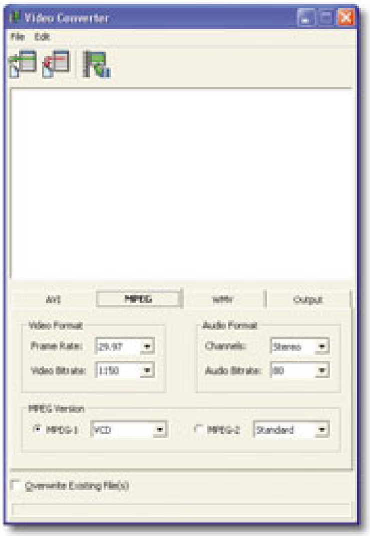


Frame Rate: 29.97
Video Bitrate: 1150
Channels: Stereo
Audio Bitrate: 80
◉ MPEG-1 VCD
○ MPEG-2 Standard
☐ Overwrite Existing File(s)

with too many choices, and the Expert mode just adds a tiny tabbed interface to the Normal mode.

The program didn't have any trouble playing video files, but encoding them to another format proved frustrating and ultimately futile. Either MediaCoder displayed a cryptic error message that it couldn't encode the video or if it did encode the video, the encoded version consisted of fragments of the original video that appeared and disappeared within seconds.

With some patience and knowledge of the program's different video settings and configuration options, you may find success in encoding your files. Given the app's beta status, however, this probably isn't a program that general users will want to use for now for anything other than experimenting. If the developer can make the app easy to encode a video that plays successfully, MediaCoder could conceivably rival commercial apps one day. Until then, this one is only for hard-core users.

Mystik Media Blaze Media Pro

Blaze Media Pro is a combination audio-video converter that works with AVI, MPEG, MOV, and WMV formats. In addition to converting video files, it can burn converted video to a VCD or DVD, capture individual video frames as still images, convert a series of still images to a video, and edit video. If you need an all-in-one video solution, this program just about has it all.

The app's video file-conversion features work simply and easily. When converting a video to an AVI file, Blaze Media Pro offers a handful of codecs, so you can experiment in a trial-and-error manner until you find the best one. For maximum audio quality, you can also specify the audio format, such as MP3 (for AVI files) or an audio bit-rate value (for MPEG files).

When choosing a codec, Blaze Media Pro lets you tweak the unique settings for that particular codec to help wring the maximum amount of compression and visual quality out of your particular video files. (This is provided, of course, that you understand what alpha channel transparency or bidirectional prediction does.)

Converting video files was a matter of loading a video into the program, clicking Convert Video, choosing various settings (such as the frame rate), and clicking Convert. While not the speediest program, the app did convert all my test files within a few minutes each. As expected, the WMV file looked visibly chunkier than the original, but not abnormally so. The program did have more trouble converting the QuickTime test file, however. The quality looked only slightly degraded, but for some reason, the converted QuickTime file included bursts of annoying static every few seconds. The app didn't introduce any static to the other test files.

Blaze Media Pro's Swiss Army Knife-like ability to convert and edit video and audio files for all the popular file formats makes it very enticing. Combined with its reasonable price and the ability to run on older versions of Windows (most other video encoders won't run under Win98/ME), Blaze Media Pro is a solid program for both novices and advanced users alike.

Pegasys TMPGEnc XPress 4.0

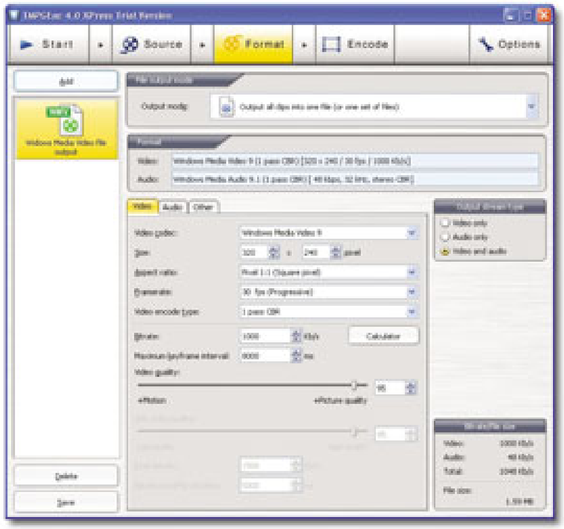
TMPGEnc XPress 4.0 converts video files to/from the most popular formats, including AVI, MPEG, DivX, QuickTime, and WMV. To make the conversion process as simple as possible, a step-by-step UI guides you through the potentially confusing process of video encoding. As an alternative to choosing a particular video file format (and understanding which settings to choose), the app also lets you define how you want to view your video (DVD, VCD, etc.). The program then chooses the optimum file format and settings automatically.

XPress 4.0 includes support for hi-def output, and it can also output video as a series of still images. For optimum speed it can use additional processor instruction sets, such as SSE and 3DNow! When saving a video as an MPEG-4, XPress 4.0 offers a handy calculator to show you how much storage space the encoded file will take up when you tweak the bit-rate setting. (Unfortunately, the calculator isn't available when saving to other formats.)

When you start the encoding process, Xpress 4.0 displays a progress bar showing how much of the encoding process has been completed. More helpful is that the app has a preview that shows exactly where in the video the encoding process is at. This also lets you preview the video's quality. If the quality doesn't meet your standards, you can cancel the encoding process without waiting for the app to encode the entire video only to realize the quality isn't up to snuff.

Encoding my 162MB test file took the app little over an hour. Encoding the smaller files took only a few minutes. At the end of the encoding process, the app offers to open the folder where the converted video is stored, letting you test the video right away without having to hunt for it manually. In my testing the application preserved video quality well with all formats, with any degradation being nearly imperceptible.

Beyond it's ability to handle a wide range of formats, novices will appreciate XPress 4.0's UI, while professionals will appreciate its various settings to tweak audio settings, to modify interleave settings, and to adjust frame sizes of a video to get optimum quality and file size. Overall, Xpress 4.0 is a solid performer that should meet the needs of nearly anyone.



TMPGEnc XPress 4.0
$99.95
TMPG
www.pegasys-inc.com
● ● ● ◖

Let The Encoding Begin

DivX Pro was the fastest app in my testing that consistently produced the highest quality video. Its ability to encode my 162MB test file in just minutes was astounding, especially compared to the hour or more it took the other programs. DivX Pro's only weakness was its inability to handle all my test files. Still, if it works with your own files and you only need to store files in the DivX format, this is a very good program. (DivX Pro was also the only app I tested that's available for Windows and Mac OSes.)

Blaze Media Pro and TMPGEnc XPress 4.0 are best suited for typical users. Blaze Media Pro can run on older versions of Win98/ME and costs half as much as Xpress 4.0, but Xpress 4.0 gets the nod for being easier to use and having greater reliability in handling QuickTime files. Turbine Video Encoder was the slowest encoder in the group for handling large files, but its ability to encode to Flash makes it unique. In its current incarnation, MediaCoder is an interesting experiment but probably not suitable for most users. ▲

by Wallace Wang

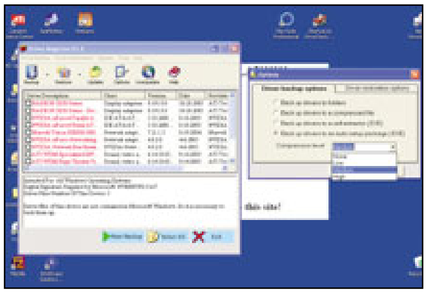
Encoders At Work

The chart below shows how the video encoders I tested performed in converting video to various file types. Results are likely to vary, however, depending on the files you use and how robust your system is. All these apps offer a free trial, so try them on your own files. For testing I used three source files, including a 360KB digital video, 162MB MPEG-1, and 2MB QuickTime file and attempted to encode them to AVI, MPEG, and WMV files. (*Turbine Video Encoder only encodes to Flash. Times are in minutes:seconds, unless noted.)

	*Blue Pacific Software Turbine Video Encoder 2	DivX Pro	MediaCoder 0.5	Mystik Media Blaze Media Pro	Pegasys TMPGEnc XPress 4.0
Source File					
360KB Digital Video Movie	830KB Flash, 0:09	Was unable to load video file with variable frame rates	N/A	4.3MB AVI file,0:50; 2.04MB MPEG-1 file, 0:28; 232KB WMV file, 3:00	5.26MB AVI, 1:00; 6.5MB MPEG-1, 0:24; 1.59MB WMV, 0:16
162MB MPEG-1 File	43.4MB Flash, 6 hours, 30 minutes	49.1MB DivX, 6:00	N/A	288MB AVI file, 23:00; 109MB MPEG-1 file, 8:00; 10.6MB WMV file, 7:00	329MB AVI, 1 hour; 411MB MPEG-1, 24:00; 109MB WMV, 15:00
2MB QuickTime File	3.35MB Flash, 0:07	1.9MB DivX, 0:17 (using DivX Mac OS version)	N/A	9.77MB AVI, 0:40; 9.94MB MPEG-1, 0:33; 0.97MB WMV, 0:12	6:03MB AVI, 0:45; 29.9MB MPEG-1, 1:00; 4.72MB WMV, 0:15

CPU RANKING ○ 0 = ABSOLUTELY WORTHLESS | ● ● ◖ 2.5 = ABSOLUTELY AVERAGE | ● ● ● ● ● 5 = ABSOLUTELY PERFECT by Marty Sems

GoldSolution Software Driver Magician 2.8



Driver Magician 2.8
$29.95
GoldSolution Software
www.drivermagician.com
●●●◖

Driver Magician attempts to save you time during clean reinstallations of Windows XP/2000 by gathering all the driver files currently in use on a PC and making a copy of each in a folder, archive, or self-extracting archive. Back up your drivers to a DVD or hard drive and reinstall your OS and DM. Use DM to restore all your drivers in one go. Alternatively, you can create an executable file with an auto setup routine, which saves you from reinstalling DM after the OS.

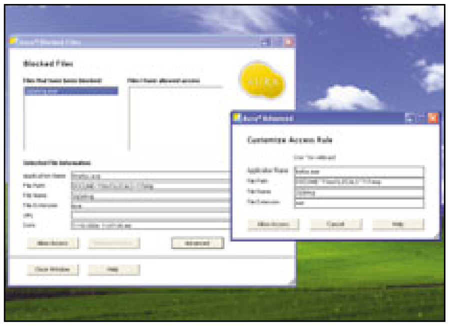
DM comes with a basic set of drivers and can check online for updates to the drivers running your hardware. However, it's up to you to install the latest versions because DM will only back up the drivers currently in use. DM stretches a bit further in the name of convenience, adding backup and restoration of IE Favorites, the Registry, the Desktop, and My Documents. Options include three compression settings, in addition to uncompressed file copying.

In my tests on a non-RAID WinXP SP2 rig, DM gathered and backed up my drivers to a 27MB automatic setup EXE with medium compression in about a minute. After a fresh OS install with an SP1-era disc (Windows Setup still expects you to provide RAID or SATA drivers on a diskette if your system needs them), I launched the autosetup file DM had made. I had to locate a few of ATI graphics card files and close several Found New Hardware Wizards per the software's Help file. After a reboot, however, seven devices were left without drivers.

I knew some drivers had special needs, so I downloaded all Windows Updates, SP2, and .NET. When I ran the autosetup driver file, DM installed all but one Nvidia nForce4 Ethernet controller. (I still had to find two ATI files.)

Driver Magician does most of what it says. If it could do it flawlessly without user interaction and incorporate the latest driver downloads automatically (with permission), it would be a lot easier to recommend for 30 bucks. ▲

Atka Software Aura



Aura
$69.95 download; $79.95 CD
Atka Software
www.getmyaura.com
◖

It sounds enticing: a security app without a subscription; its one-time cost includes licenses for five PCs. So what's not to like?

Aura takes a simple approach to security: It tries to block every executable that attempts to download and launch on your PC, such as drive-bys. Aura also blocks most EXE files that you want to download unless you say they're OK. It doesn't detect or remove any spyware or viruses.

Aura runs in the background under Windows XP/2000 with .NET 2.0. The app doesn't need fresh definitions like antivirus software, but it does phone home for its latest version by default. When you want to download and install a program, you temporarily suspend Aura's protection. The app offers to create a System Restore Point before acquiescing.

What floored me was the site's irresponsible dismissal of the need for a supplemental firewall, AV, or antispyware utility. "If you use your computer mainly for email and never or rarely download commercial programs, Aura may be all the protection your computer needs."

To test this I used a WinXP SP2 PC with a bare-naked broadband connection and only Aura for security software. Aura blocked most (but not all) EXE downloads through IE, Netscape, and Firefox. Aura also ignored any EXE that I smuggled through Mozilla's SeaMonkey browser. It didn't block Windows Update, Java's updater, or the EXEs I launched from optical discs or the hard drive—even installers notorious for bundled adware. It did block some update and cleanup processes from Netscape 8's installation routine.

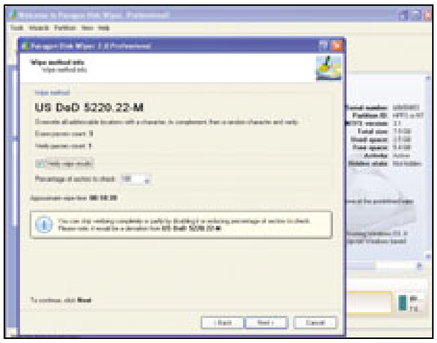
Worse, the first malware-laden site I visited with IE gave me drive-by installations of the MySearch toolbar and the Downloader.Agent.P trojan. Trend Micro's online scan found 27 BHOs and 61 instances of adware. Spybot and Ad-Aware found others, including BookedSpace.

Despite Atka's wild claims, Aura isn't enough to safeguard your PC by itself. If it were free, I might recommend it as something to augment the traditional security apps you'll need anyway. As it is and at this price, what's the point? ▲

CPU RANKING ○ 0 = ABSOLUTELY WORTHLESS | ●●◖ 2.5 = ABSOLUTELY AVERAGE | ●●●●● 5 = ABSOLUTELY PERFECT

by Warren Ernst

Paragon Software Disk Wiper 7.0



Disk Wiper 7.0
$29.95 (Personal);
$149.95 (Professional)
Paragon Software
www.disk-wiper.com
●●●●

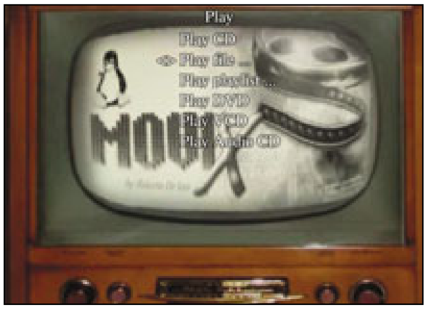
If recent media reports have shown anything, it's that data can survive and is recoverable from all sorts of computer drives, even those thought to have been erased with Windows' built-in delete commands. To prevent data from lingering on, various governments, military forces, and law enforcement agencies have devised various schemes to thoroughly delete files (and clean free drive space), leaving it up to software developers to create the software to actually do this. Paragon Disk Wiper is such a program. While it has a clean, simple interface and nearly a dozen secure erasing methods, it comes at a price that won't make the app suitable for everyone.

DW comes in Personal ($29.95) and Professional ($149.95) versions. Both versions share the same excellent, wizard-driven interface, but the Personal version only uses Paragon's data-sanitation method or a custom method you devise. The Pro version includes 10 methods (see the full list at www.disk-wiper.com), including methods the U.S. Department of Defense and Navy and British, Russian, Australian, Canadian, and German agencies and other entities helped devise. Presumably, if your company requires you to use one of these methods, the Pro version is what you want.

DW can wipe out entire drives, entire partitions, or unallocated space on a drive, but curiously there's no provision for securely erasing individual files short of deleting the file normally, emptying the Recycle Bin, and doing a Free Space Wipe. Another irritant is that occasionally the program refuses to wipe drives already mounted and in use by Windows. Professional users can create a DW boot disk (floppy or bootable CD) that offers the same functionality (although with a different, but still nice, GUI), but Personal users are stuck rebooting Windows in Safe Mode and hoping for the best.

There are more flexible, secure, and less expensive erasers geared for home users than DW Personal (notably Heide Computers' Eraser), but the Pro version's combination of a stellar interface and expansive sanitation methods makes it a worthwhile (if not expensive) secure, erasing option. ▲

MoviX



MoviX
Free
Roberto De Leo
sourceforge.net/projects/movix
●●●

You may think that old, hard driveless Pentium II you have in a closet collecting dust is utterly useless, but the MoviX development team would disagree. Although the software isn't a process without a few pitfalls, MoviX let's you build a bootable CD (or DVD) that can play all sorts of disc-based and Internet-based multimedia. Additionally, the app is small enough to even make self-playing multimedia discs.

Not surprisingly a compact Linux distro powers MoviX, along with the excellent MPlayer media player. Some Linux knowledge is handy for constructing a disc with all the bells, whistles, and codecs you need. However, thanks to a Windows-based front end, even Windows-only techies have a good chance of building an ISO file with all the Linux files and some media files, as well. (Be sure to read all the ReadMe files carefully, and you'll also need to search a bit to locate DVD-playback files.)

MoviX only takes up 20 to 30MB on a CD, leaving lots of space for media (such as MPEG-4, QuickTime, and DivX videos; MP3 and OGG audio; and various still-image formats). The MoviX distribution is so small, however, it loads entirely into RAM, letting you remove the bootable CD and insert other optical media, such as a DVD or audio CD. If you can remember the URL, you can also listen to Internet radio or browse and play content on FAT32- or NTFS-formatted hard drives.

There are certainly some things that MoviX lacks in order to stay so compact, including a meaningful GUI and modern hardware support. You'll also need to memorize dozens of keyboard shortcuts (or more realistically, write them down) to perform basic tasks. Getting support for modern Nvidia video cards will have you cruising discussion forums looking for the right combination of files and their locations, and developer support has also been waning, meaning a magic 1.0 release may never come. Still, for those willing to tinker to get old hardware back in service, MoviX is an interesting project that may be worth the effort. ▲

CPU RANKING ○ 0 = ABSOLUTELY WORTHLESS | ●●◖ 2.5 = ABSOLUTELY AVERAGE | ●●●●● 5 = ABSOLUTELY PERFECT

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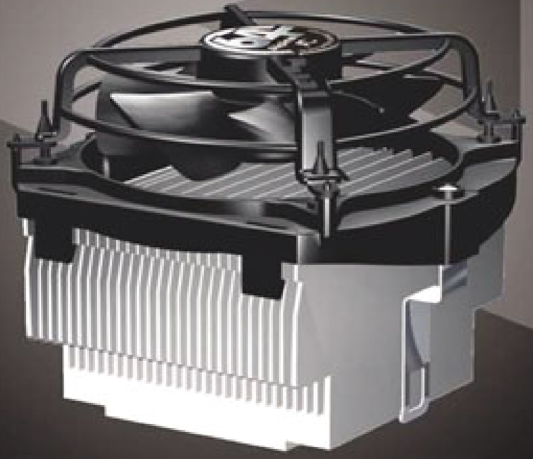

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High Cooling Performance

Alpine 7: 0.26°C/W
Intel Pentium 4 Box Cooler: 0.23°C/W
◀◀◀ Better

Alpine 64: 0.26°C/W
AMD Athlon 64 Box Cooler: 0.34°C/W
◀◀◀ Better

Extremely Quiet

Alpine 7: 0.6 Sone
Intel Pentium 4 Box Cooler: 4.9 Sone
◀◀◀ Better

Alpine 64: 0.6 Sone
AMD Athlon 64 Box Cooler: 2.6 Sone
◀◀◀ Better

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Muse, Sick

by Chris Pirillo

Growing up, my brothers and I were exposed to a wide array of music, though it wasn't a completely pervasive experience. We had the child stuff, naturally, and Mom pulled out her favorite 45s of yesteryear when she was feeling nostalgic. If the radio was tuned into any station, it was either country or oldies from the '50s. There were Beatles' and Monkees' albums collecting dust in the basement, and Dad had a few Everly Brothers tapes in the car's glove compartment for good measure. Music wasn't everywhere for us, and it certainly wasn't convenient and accessible. We didn't even have a "stereo" at home.

I vividly remember listening to Styx on vinyl at our cousins' place; my brothers and I draped the oversized headphones atop our ears and played "Mr. Roboto" over and over and over again. Right before entering the seventh grade, I was awakened to the social aspect of music. Suddenly, my choice in artists became excruciatingly important, and that summer's introduction to Weird Al Yankovic would prove to be a definitive moment in my life. I bootlegged tapes before I could afford to buy my own, though my first two album purchases (cassettes) were Twisted Sister's "Stay Hungry" and Van Halen's "5150."

Feeling nostalgic yet?

Were today's Napster and tomorrow's Urge in yesterday's childhood, I would have been made a better man. Music subscriptions are changing the way our lives are lived, and if you haven't yet taken the plunge, one such all-access audio pass could very well be the best $10 a month you will ever spend. Certainly, radio is still free (and sufficient for most audio cravings). Yes, you will likely still support your favorite artists and purchase their merchandise regularly. But what if you just want to listen to something without searching for the MP3 on your home network or flipping through your extensive CD collection in the media room first?

Like most people, I'm a casual listener. For this reason and this reason alone, I feel Apple's iTunes model is completely broken for the consumer. Understand it's also broken for artists (as revealed recently by the aforementioned artist, Weird Al Yankovic). Ala carte works well for lunches, but it just does not make sense for music when you could easily spend the same amount of money for unlimited access to millions of songs. If only Apple would open its iPod platform and let me take my music subscriptions with me wherever I went, like any given Windows Media device. Apple wants me to live in 1984, when I had to buy a physical product to use it *ad infinitum*. Problem is, digital music is made up of nothing more than virtual bits. We're not living in 1984, Apple, so why are you still pretending?

Every week, without fail, someone claims that there's an iPod killer coming, and it is right around the corner. Have you seen one yet? Of course not because it doesn't (and never will) exist. Brands can't easily be toppled! If anybody outside of Apple's camp really wants to create a killer, they need to give high-quality hardware away in exchange for annual music subscriptions. The industry's best chance is with Windows Media Player 11, MTV's Urge, and iRiver's clix—all three combined could give the iPod and Apple a serious run for its money. Buy either the hardware or subscription, get the other one free. Even iPod owners would find that a difficult offer to pass up.

But it won't happen. Why? Ego. It will be a cold day in hell before any vendor other than Apple topples Apple's personal lifestyle empire and iPod brand, and they all want to do it independently. If only they'd stand together as one, we might have a shot at making this market a little more competitive. This new music industry is just as sick as the old one (which is still alive and kicking). And it's going to get infinitely worse before it gets better. We'll have self-righteous digital pirates, overpriced content vendors, asinine DRM systems, a slew of noninteroperable media devices, more proprietary formats, more choices, more headaches. . . .

Suddenly, the quaintness of my mom's record player spinning Marty Robbins' "Ballad Of The Alamo" doesn't sound too bad, doesn't sound too complicated, and it doesn't sound like we've really made this as simple as it should be. ▲

Chris Pirillo is completely shocked that readers responded to his offer in his previous CPU *column (August* CPU*, page 79). He's also sure you haven't visited any of the following sites yet today: bLaugh.com (the unofficial comic of the blogosphere), TagJag.com (where you can search for and subscribe to RSS feeds), Chris.Pirillo.com (his personal blog, which you can also find by searching for "Chris" on Google), ChrisPirillo.com (his podcast), Lockergnome.com (a tech-content network), Gnomedex.com (the annual new media tech conference), and let's not forget RentMyChest.com. On second thought, let's forget that one.*

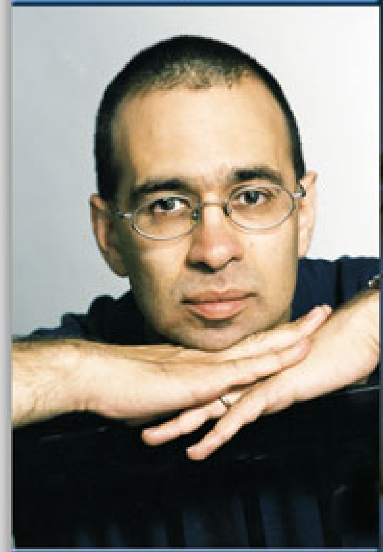
> Like most people, I'm a casual listener. For this reason and this reason alone, I feel Apple's iTunes model is completely broken for the consumer.

You can dialogue with Chris at chris@cpumag.com.

Open Sauce

On The Internet, Someone Knows You're A Dog

by Pete Loshin



Pete Loshin, former technical editor of software reviews for Byte Magazine *(print version), consults and writes about computing and the Internet. He also runs www.linuxcookbook.com. He owns shares of both Microsoft and Red Hat and believes that Windows isn't for everyone, but neither is Linux.*

All Internet traffic flows inside packets, each comprised of a strictly defined set of data fields, and all of them conform to completely open Internet standards to assure interoperability and accessibility between any computers that support the TCP/IP Internet protocol suite. To those who need to monitor and analyze Internet traffic, whether they use a commercial package (reportedly built on a Linux platform) like those that Narus (www.narus.com) or Wireshark (www.wireshark.org; the open-source project formerly known as Ethereal) offers, each packet is nothing more than a single record in the world's biggest database.

How big? Let's make some conservative approximate assumptions: IP packets are usually no bigger than 1,500 bytes; other than session-administration and other network-management functions, most packets carrying data will be at or near the maximum. If an average Internet session involves about 150MB worth of data, that's about 100,000 packets. If two out of three Americans (about 200 million) log on each weekday, that's approximately 20 trillion packets per day, 400 trillion packets per month, 40,000TB of data. Storage needed to archive traffic for a year? 480,000TB. Consider, also, that estimate of session traffic may be way low. YouTube videos are up to 100MB, and the 128Kbps audio stream from my favorite radio station generates over 130,000 packets per hour. If I'm average, multiply everything by 10.

For comparison, consider AT&T Labs Project Daytona (www.research.att.com/~daytona) for "Managing Data at AT&T Scale." AT&T has a selection of more or less open-source software. I really like the example it gives of a "big" database: "For example, Daytona is managing over 312TB of data in a 7x24 production data warehouse whose largest table contains over 743 billion records as of Sept. 2005. Indeed, for this database, Daytona is managing over 1.924 trillion records; *it could easily manage more but we ran out of data.*" The emphasis is mine. I wonder if Daytona can handle the significantly larger database of all IP packets generated in a month (or year). And make no mistake, the individual database record, the IP packet, is just a database record. Fields identify the packet's source and destination, the kind of data the packet contains, the data itself, and more. It's enough data to reconstruct any Internet session you want, from anyone's email to any Web surfing session, IM interactions, and even Internet telephone calls. (While Daytona is proprietary, AT&T Labs offers other software under open/noncommercial licenses; see public.research.att.com).

As a database you can do much more with all these packets. You can slice and dice them just like any other database to produce reports of unimaginable variety. For example, you can identify the source or destination of packets being sent to nonstandard ports, track down computers being used to connect with computers in a specific country, capture information about encrypted packet streams for traffic analysis, and even detect increases in transmission of malformed packets or other indicators of impending DoS attacks.

If the TCP/IP suite wasn't so open, large-scale network monitoring wouldn't be so easy, but the Internet wouldn't be possible on the global scale we've become used to. Instead of one huge Internet, we'd have parallel, tunneled, and intertwined networks running protocols that Microsoft, Novell, Cisco, and other major network players owned, as well as TCP/IP.

Does this mean that privacy is dead? Perhaps; there are currently no practical technical fixes to keep your network activities private. However, you can only monitor networks to which you have access, so collecting the sum of all U.S. Internet traffic, for example, is more complicated than simply monitoring a national backbone. That only gives you traffic routed over that backbone. You'd need to capture all packets that every ISP carries and then cross-reference them all to discard duplicates. A typical packet will traverse a source ISP, regional and/or national backbones, and a destination ISP. Complicated but still plausible, and a good reason to remember that these days on the Internet, *someone* knows you're a dog. ▲

If two out of three Americans (about 200 million) log on each weekday, that's approximately 20 trillion packets per day, 400 trillion packets per month, 40,000TB of data.

You can get saucy with Pete at pete@cpumag.com.

The Web Gets Mobilized

Cell Phone Browsing Gets Real

If on the way to the airport you often wonder if your flight is on time, try opening your cell phone's mobile Web browser and navigating to the airline's mobile Web site to check. Yup, your airline probably has one. In fact, few cell phone owners realize that much of the Web is available on their phones in formats designed for handsets. Google, Yahoo!, MSN, CNN, ESPN, UPS, FedEx, The Weather Channel, MapQuest, and Moviefone, among thousands of others, are investing in refitting their services for WAP-enabled Web sites specifically designed for phone access. Only a few years ago, phone service was so slow, and the original WAP protocols so inelegant, that even early adopters gave up on initial dreams of browsing the Internet via handsets. Not anymore.

The Mobile Web Finally Gets The Call

In 2006 much has changed. High-speed phone networks using EVDO (Evolution Data Optimized) wireless standards are available nationwide from both Verizon and Sprint. These 3G networks bring near-broadband speed to enhanced multimedia handsets with larger, more detailed screens that hold much more information than earlier models. The basic mobile Web standard has evolved to WAP 2. The standard coding language of mobile sites has become XHTML, which makes them more adaptable to various displays and is much more compatible with the design and information flow of the rest of modern Web sites. But most of all, the Internet companies themselves now believe the mobile Web is for real. With a growing percentage of the 200 million U.S. cell phones equipped with a WAP browser, the installed base for the mobile Web is too staggering for any Web company to overlook. "The consumer experience has improved," says Louis Gump, VP of Mobile at TWCi (The Weather Channel Interactive). "We are at the early end of a new stage of development. The overall trend is that mobile is going or has gone mainstream. We are seeing significant revenue, product improvements, and integration across the platforms."

Early .mobi sites only have to obey three rules to keep their mobile sites online: never use a "www" prefix in the address or use frames, but do code the site in XHTML.

The Web content publishers are on the mobile Web because the audiences are coming here already. According to M:Metrics, by the end of 2005 about 10% or 18.5 million U.S. mobile phone subscribers used their phone's Web browser at least once a month to access information. When hurricane season started in 2006, The Weather Channel started posting its severe weather updates to its mobile site. "We had a very significant percentage of page views coming from mobile," says Gump. "The reason [the mobile Web] will be significant is that it's a way to give consumers the information they want, when they need it." Along with ESPN, CNN, *Maxim* magazine, Fox, CBS, and *USA Today*, The Weather Channel is among the vanguard in wireless content development.

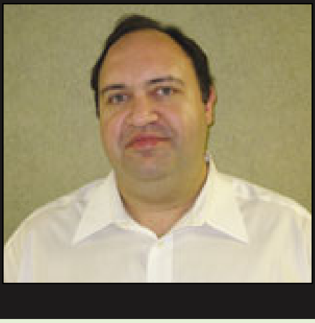
Like 1998 All Over Again

The great turf battles of the early Web are being re-enacted now on mobile. For instance, the major Web search engine portals, Google and Yahoo!, have already taken their legendary struggle for user hearts and minds onto the phone. Yahoo! has a suite of applications that lets users access email and instant messaging on handsets, and Google lets users access its Web home page in a customized format on the browser.

The mobile battlefield could also rearrange the digital branding deck a bit. Despite Google's overall dominance online, Yahoo! reigns supreme in mobile content use, while declining Web giant AOL is executing a remarkably strong mobile strategy by giving AIM users the ability to use their existing buddy lists to instant message on phones. “Although these are early days in mobile media, the aggressive efforts in mobile by Yahoo! and AOL are paying off,” says Mark Donovan, VP products and senior management at M:Metrics.

And according to Donovan, mobile Web use will spike radically as users worldwide quickly adopt high-speed networks. Just as broadband penetration accelerated Web use in the early part of this decade, faster, smoother mobile Web experiences are making this platform more popular. One of the major reasons companies are promoting high-speed networks is because they hope users will adopt more data services such as downloadable applications and general mobile Web use.

Q&A Vance Hedderel: Toward A Domain Of Our Own



Launching an exclusive domain suffix just for mobile Web sites this summer, mTLD first opened registration to trademark owners who secured the .mobi address for their own brands. Sometime this fall, registration opens up to anyone who wants to build a mobile Web site under the registry’s basic design requirements. Vance Hedderel, director of communications, tells us what .mobi requires and why we need a .mobi domain at all.

CPU: The .mobi suffix is unique among TLDs in that it enforces certain design requirements. What are they?

Hedderel: The mandatory rules are fairly simple. There are three: First, the site must be in XHTML. Second, there is no second-level domain in the address; no ‘www’ to translate. And third, there should be no use of frames. These are the mandatory rules. We have recommendations that are based on the W3C Mobile Web Best practices 1.0. These rules and best practices ensure that content developers of mobile phones will work on any mobile device with an integrated Web browser.

CPU: Yours is the only TLD registry that actually has the power to enforce rules on domain owners. How will you do that?

Hedderel: We have the equivalent of a Web crawler that sniffs out sites and checks for compliance on a quarterly basis. [If they don’t comply] we would give people a first and second warning and only then would we turn off the site, but not take away the domain. The idea is not to slap hands but to ensure for consumers that sites make sense on their cell phones.

CPU: Speaking of crawling, how does .mobi work in concert with traditional search engines?

Hedderel: We’re working with the search engines in optimizing their search results so that if you are on a mobile phone and search, the .mobi sites will come up first in the results.

CPU: There is some controversy surrounding whether we need a .mobi domain and such rules. The rules are basic and obvious already to most designers, and many .com sites automatically serve users a mobile Web page when they use their phone browser.

Hedderel: The idea is to put unification around this, so that when you type .mobi it will work on your cell phone. If you are a big company, many of them have set up browser sniffers that know you are coming in from a phone and feed up a WAP version of the site. That’s great if you have the resources to build up that way. But there are thousands of .com developers that don’t have the resources. When I hear that comment, I hear it coming from the developers who are at the cutting edge of what can be done. But is it helpful to the consumer to access the information in a consistent way?

Your Mobile Bookmarks

Want to get the most from the mobile Web? Flip open your phone and key in some of these URLs.

Yeswap.com. A superb directory with direct links to scores of WAP sites organized by topic. For browsers who want to see what is available on the mobile Web, this is your starting point.

Google.com and Yahoo.com. Both major search and content addresses distinguish mobile traffic and kick you over to a WAP Web design that lets you sign into and bookmark your personal Google or Yahoo! home pages.

Wap.espn.com. Sports headlines, scores, and even some of the earliest examples of mobile Web ad banners at what may be the most popular mobile Web site of them all.

Weather.mobi. The Weather Channel’s demo site (customizable to your locale).

Mobile.seatguru.com. You’ll always know where you’re sitting with this directory that gives you precise seat maps to every plane in the fleet of the major carriers.

Dictionary.com. The online dictionary, thesaurus, and encyclopedia in the palm of your hand.

Mobile.ups.com and Mobile.fedex.com. Plug in tracking numbers or find drop off locations.

XE.com/wap. Currency converter.

In fact, some corners of the mobile Web have become staggeringly popular. For instance, sports fans have embraced the phone as the best, on-call source for the latest scores. It's not surprising that the most advanced and trafficked mobile Web site in any content category is Mobile ESPN (wap.espn.com). The WAP destination already claims 200 million monthly page views and 4 million unique visitors, all coming in by phone. According to Kristen Fox, associate director for product at Mobile ESPN Publishing, the company is already serving small banner ads on many of these pages for sponsors such as Chili's and Visa.

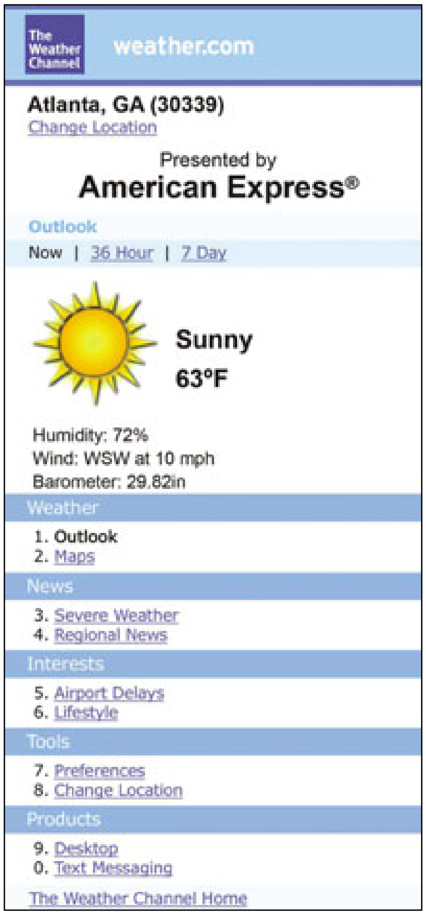
Big Web, Teeny Platform

Making the Internet work on cell phones is no easy matter. The diversity of handsets, screen sizes, and network speeds challenges Web designers in ways the standard desktop Web doesn't. Hoping to accelerate adoption of the mobile handset as a Web browser, ICANN granted a consortium of Web and wireless companies control of a new .mobi TLD accessible only to mobile WAP browsers. The company, mTLD, includes Ericsson, Google, Microsoft, Samsung, and T-Mobile, and others, and hopes to impose standardization on the mobile Web. By implementing some mandatory rules (see the "Q&A" sidebar with Vance Hedderel, director of communications at mTLD and dotmobi.org, on page 81) offering best practices for mobile site design and providing major brands shorter URLs, mTLD wants to make typing in **CNN.mobi** on a phone as intuitive and predictable as entering a dot-com on the desktop.

In order to get a .mobi Web address, registrants must agree to some basic design principles (again, see the Q&A sidebar) that mTLD will enforce. The first stage of registering .mobi domains began this summer with a "sunrise registration period" that let trademark owners such as Virgin, Target, eBay, and Ferrari claim ownership of their branded .mobi addresses. According to Hedderel, the initial sign-up proved so popular that the sunrise period was being extended through the summer and then will be opened up to anyone wanting a .mobi address later this fall. Google.mobi, nokia.mobi, and weather.mobi are already up in early demo form, but "you won't see hundreds until autumn," says Hedderel.

The move to construct a dedicated mobile domain is not without controversy. Some veteran Internet thinkers, including Tim Berners-Lee, question whether a device-dependent domain such as .mobi violates longstanding goals for an open Web where any site should work across all devices. Nevertheless, the 3WC has issued the first set of best practices for mobile Web development. Among the 3WC's recommendations, developers are urged to assume at least a 120-pixel screen width, use XHTML code, restrict images to JPEG and GIF 89a formats, and work within a total page weight of no more than 20KB.

Dotmobi.org is adopting and recommending the 3WC mobile Web guidelines in order to help standardize the experience of mobile users so that they themselves can come to discover how the Web works in a mobile context. Users aren't going to spend their time browsing the Internet by phone in the same way they do on desktops, says Hedderel. The vision of moving the Internet into our pockets may seem large, but the beauty of it comes in how a mobile Web streamlines the small everyday things. CPU


The Weather Channel weather.com

Atlanta, GA (30339)
Change Location

Presented by
American Express®

Outlook
Now | 36 Hour | 7 Day

Sunny
63°F

Humidity: 72%
Wind: WSW at 10 mph
Barometer: 29.82in

Weather
1. Outlook
2. Maps

News
3. Severe Weather
4. Regional News

Interests
5. Airport Delays
6. Lifestyle

Tools
7. Preferences
8. Change Location

Products
9. Desktop
0. Text Messaging

The Weather Channel Home

The 3WC recommends that all mobile Web pages use XHTML to ensure compatibility and a good user experience on most handsets.

Tiny ad banners are already appearing on mobile sites from major brands such as ESPN and Weather.com.

by Steve Smith

Infinite Loop

Desktop Pals

We're always looking for a good toy to play with, uh, we mean research. With the little guys from Cube World nearby, you may never be able to focus again. You can create your own Cube World by stacking the four characters (Slim, Scoop, Dodger, and Whip) in any configuration. Each character has his own activity, but when you join them together, they interact with each other. Sometimes they play nicely; other times they duke it out. But whatever it is they decide to do, it'll be fun to watch. ▲

Source: www.firebox.com/index.html?dir=firebox&action=product&pid=1201

The Department Of Stuff

download.txt

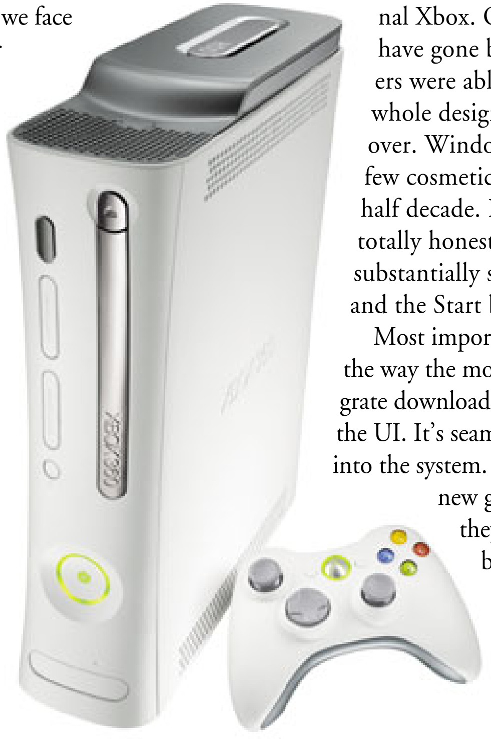
by Rob "CmdrTaco" Malda

Rob "CmdrTaco" Malda is the creator and director of the popular News for Nerds Web site Slashdot.org. He spends his time fiddling with electronic gizmos, wandering the 'Net, watching anime, and trying to think of clever lies to put in his bio so that he seems cooler than he actually is.

It seems like the place you need to look for real innovation these days is the video game market. From the PlayStation 2's use of the DVD to the PlayStation 3's planned inclusion of an honest-to-goodness high-def format, analog control sticks to the utterly insane but brilliant wand for the terribly named Nintendo Wii, and from user interfaces glistening with shiny chrome, the consoles always have it first. In the world of downloadable content, they are once again worlds ahead of the game.

I think the problem that we face with looking to consoles for serious innovation is that many people still perceive them as gaming machines for children. And all of this in spite of the fact that demographics show gamers in their 20s and 30s are the ones who are spending all the money on gaming. Anyone who has ever popped the lid off the original Xbox can tell you that this system is just a PC in a black box.

But spend some time wandering around in the user interface of any of the modern consoles and you will notice that animation clearly indicates what your action was and what affect it has had on the screen. This is in contrast to most traditional interfaces where many times a click results in something happening; however, there's just no visual cue to the user to tell them just what exactly it was.



Nowhere is this bad design more evident than the Internet. To be fair, much of this is because the Web is built on layer after layer of abused technology. All of the people that designed a Web site in the '90s used a table tag for layout because CSS didn't exist back then. It was an awful abuse, and it usually still is.

Now video games have another added advantage: They don't have to carry with them the legacy of their past. Most every Windows program at some level looks like a Windows program; a Mac, a Mac. Nearly all Linux programs look like whatever toolkit the coder created. There are exceptions, but they are fairly rare.

Video games don't have this problem. Every new game is a chance to try something new: A designer may or may not choose to inherit good elements of design from his previous game. The Xbox 360 UI looks nothing like that of the original Xbox. Only a few years have gone by and still developers were able to throw the whole design out and start over. Windows has had only a few cosmetic changes in the last half decade. But if we are being totally honest, it hasn't changed substantially since Windows 95 and the Start button.

Most importantly, though, is the way the modern consoles integrate downloadable content into the UI. It's seamlessly integrated into the system. You can acquire new games or modules; they download in the background. It's simple and elegant. It's just the sort of advantage you get when you start with a clean slate.

It makes me wonder what the next clean slate in the computing world will actually be—it sure does not look like it will be Vista. But with innovations such as the Nintendo Wii wand coming into the picture, these sorts of things could have a far more dramatic impact on the world of user interfaces than the Start button or Expose. Those are silly little ideas that have their place but will not rattle any foundations.

All of this makes me wonder if there is any substance to those ongoing rumors about Apple buying Nintendo. The more you think about it, the more sense it makes. ▲

It seems like the place you need to look for real innovation these days is the video game market.

Contact me at malda@cpumag.com

ROAD Warrior

by Jen Edwards

Samsung Provides A New Vision Via Fashionable Cameras

A new line of slim, stylish digicams from Samsung with slick, black aluminum cases and several built-in mobile characteristics should be heading our way this fall. The NV (New Vision) line will launch with three models, including the multimedia powerhouse NV3, a 7.2MP model that also functions as a music and movie player (via a PMP) and an ebook reader via a special audio-processing chip (3D, Jazz, Rock, and more sound effects included) and integrated stereo speakers. A headphone jack is also included, and the camera has a 2.5-inch display, 5X digital zoom, and an ASR (Advanced Shake Reduction) feature.

The NV7, also a 7.2MP model, offers up features such as 7X optical zoom and additional shooting modes for more advanced photographers. The NV10 has very impressive 10.2MP shooting capabilities and a manual exposure option, but it only has 3X optical zoom and 5X digital zoom. All the new NV cameras can also shoot MPEG-4 video clips at varying quality levels. Additionally, both the NV7 and NV10 have a new Smart Touch user interface and 19MB of internal memory. The NV7 will reportedly sell for $450, the NV10 $400, and the NV3 $350. ▲

Energi To Go

Energizer is launching a new product line called Energi To Go that consists of battery-powered chargers for mobile devices, including cell phones, music players, and portable gaming consoles. The line will include three versions depending on the device, with each charger including a two- or four-cell charger with an appropriate charger connector.

Energizer says the Energi To Go Cell Phone Charger will support a wide variety of cell phone models (reportedly 80% of all brands sold in the United States) from such manufacturers as Motorola (including the RAZR and SLVR models), Nokia, and Samsung. The charger will also support mini USB devices, such as BlackBerrys. The pack will include a reusable two-cell charger, two Energizer e2 Lithium AA batteries, and a charger connector for an expected retail price of $19.99.

Energizer
Energi To Go
AUDIO POWER PACK
Charges Your iPod To Full Power
Energizer
Energi To Go
INSTANT CELL PHONE CHARGER
POWERS most MOTOROLA CELL PHONES
POWER TO TALK. POWER TO CHARGE.

The Energi To Go Audio Power Pack will be available for Apple iPods, including the mini and nano. The Energi To Go Gaming Power Pack will be available for the Sony PSP and Nintendo's DS and GameBoy Advance systems. The audio and gaming versions will sell for $29.99 and have a four-cell charger and the necessary charging connectors. Connectors will also be available separately so consumers with multiple devices can power them all via a single Energi To Go charger.

A specific launch date hadn't yet been set for the chargers at press time, but they're expected to launch in stores nationwide starting in early September. ▲

Microsoft Working On Portable Music-Video Player

Details are still sketchy, but Microsoft is in fact working on creating its own portable music-video player, dubbed Zune, that will compete with the iPod. The device is expected to offer wireless-connectivity options that will let consumers directly download music and video without having to dock it with a personal computer. Other technical details were sparse at press time, but it's widely expected Microsoft's music player will be available by this holiday season. Microsoft has reportedly been in talks with major record labels regarding the possibility of setting up an online music store similar to iTunes. While consumers have flocked to the simplicity of iTunes, music industry insiders have complained about Apple's pricing structure. Microsoft's effort had been dubbed Project Argo until recently. ▲

Sharp Offers PV200 Wireless Sidekick PDA Stateside

Sharp recently launched in the United States the PV200 Wireless Sidekick PDA, a small mobile phone/PDA combo device with some impressive features. Measuring 2.3 inches high x 5.1 inches wide and less than an inch thick, the PV200 includes a 65K color, 2.6-inch TFT display and a 1.3MP camera with flash. A full QWERTY-style keyboard hides under a sliding screen, and a miniSD card slot is built in for memory expansion.

The PV200 is a GSM phone with GPRS and EDGE data capability. The device offers high-speed access to Web browsing with JavaScript support, plus email and always-on connectivity to such chat apps as AIM, Yahoo! Messenger, and MSN Messenger. The PV200 can also play MP3s and has integrated PDA functionality based on technologies that Sharp uses in its Zaurus handhelds. Calendar, address book, to do, and notes apps are included. Pricing and availability hadn't been announced at press time, but photos of the PV200 on Sharp's Web site show the device with T-Mobile branding. ▲

Wireless PDA <PV200> for the U.S. Market

Back To School With A New Notebook & Some Tunes

In the old days, back-to-school notebooks were of the three-ring binder variety. Today, however, notebook computers are becoming increasingly more common in college classrooms. This fall, for instance, the Virginia Polytechnic Institute will issue incoming engineering students with Fujitsu LifeBook T4000 convertible tablet PCs that the students will be required to use in the classroom. As part of a partnership with Fujitsu and Microsoft, each computer will include Microsoft Office OneNote, SketchUp, and Classroom Presenter apps, which faculty members have been in training for during this summer to use in classroom lectures this fall.

Gateway is also supporting the educational market. The company recently announced a $6.5-million, one-year contract with Winona State University in Minnesota to provide 4,200 M285 Convertible Notebook PCs to students, faculty, and staff. This is the seventh year of the Gateway/WSU partnership, which represents the largest, single implementation of tablet PCs in the higher education market. Gateway has also introduced new notebooks for the back-to-school market, including a budget-priced NX560 series with Windows XP Media Center Edition starting at $899.

If you're a Mac OS fan and know a student in college, let her in on this recent Apple promotion: Purchase a MacBook, MacBook Pro, or select desktop models with an iPod nano and receive a mail-in rebate of up to $179. You can combine the offer with a rebate of up to $100 with the additional purchase of select printers. The deal runs through Sept. 16. ▲

Sony Offers Micro Vault USB Drives; Lexar Recalls 66,000 Defective JumpDrives

Joining a trend of using aesthetic design to market electronics to female consumers, Sony has introduced a new line of Micro Vault Tiny USB drives in various colors. Capacities range from 256MB to 2GB (a 4GB is set for release later this year) in such colors as mint green, pale blue, lavender, and soft orange. The drives are just over an inch long, and Sony is including a small case attachment for protection and to prevent losing it. Originally announced only for the Korean market, the drives should be available nationwide as you read this. Prices range from $30 to $200.

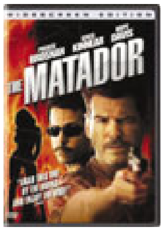
In related news, concerns about potential overheating and personal property damage have prompted Lexar to issue a voluntary recall of approximately 66,000 USB drives sold in April and May 2006. The five models included in the recall include 256MB, 512MB, 1GB, and 2GB JumpDrive FireFly models and the 1GB JumpDrive Secure II. Specific serial number ranges and return/replacement instructions are available at Lexar's Web site. ▲

At Your Leisure

The entertainment world, at least where it pertains to technology, morphs, twists, turns, and fires so fast it's hard to keep up. But that's exactly why we love it. For the lowdown on the latest and most interesting releases in PC entertainment, consoles, DVDs, CDs, and just leisure and lifestyle stuff we (for the most part) love and recommend, read on.

Audio Video Corner

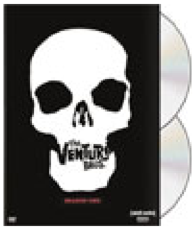
DVDs by Chris Trumble, CDs by Blaine A. Flamig



$28.95
The Weinstein Company
www.matadorthemovie.com

"The Matador"

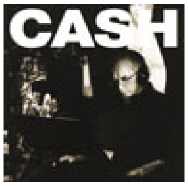
In "The Matador," Pierce Brosnan is back and turns in his best performance since "GoldenEye" in 1995. His character, Julian Noble, is a burnt-out hit man who comes face to face with the consequences of his chosen life when facing a birthday all alone while in Mexico on "business." Just as he seems certain to spin out of control, he bumps into Danny Wright, a corporate salesman played by Greg Kinnear who is also going through a bit of a rough patch, and the unlikely pair strike up a friendship that has a profound impact on both their lives. Kinnear is excellent as usual, and the juxtaposition of Wright's aw-shucks, straight-laced mentality with Noble's hard-charging, take-no-prisoners lifestyle creates plenty of humor and a bit of profundity, as well.



$29.98
Turner Home Entertainment
www.adultswim.com

"The Venture Bros." Season One

One of our favorite Adult Swim offerings is a twisted parody of '60s adventure cartoons like "Jonny Quest." Dr. Rusty Venture is the bitter and mostly washed-up son of famous inventor Jonas Venture, who gets into all sorts of scrapes with powerful villains and whose sons Hank and Dean are blissfully ignorant of how messed up their world is. "Venture Bros." is one of the funniest shows on TV, thanks to excellent writing and voice talent, the latter of which includes Patrick Warburton as Dr. Venture's killing-machine bodyguard, Brock Samson. Season One is a two-disc set containing 13 episodes and the kind of extras you've come to expect on Adult Swim DVDs. Our recommendation? Strong buy.



$14
American Records
www.johnnycash.com

$15
DMZ/Columbia
www.ralphstanley.net

Johnny Cash—"American V: A Hundred Highways"
Ralph Stanley—"A Distant Land To Roam: Songs Of The Carter Family"

Country music icons Johnny Cash and Ralph Stanley are so intertwined for reasons obvious and not, it makes sense to look at their recent records together. Thanks to last year's biopic "Walk The Line" and a rash of records released after Cash's death, nearly everyone knows by now that Cash married June Carter, and they shared a storied bond until June died in 2003. What fewer people know is that June was the daughter of "Mother" Maybelle Carter, who with cousin, Sara, and Sara's husband, A.P. Carter, formed the first family of country music, The Carter Family, in the 1920s. The group's recordings are still considered the blueprint on which country music was built, and it was the Carter's traditional, Appalachian songs of mourning, death, and hardship that Ralph Stanley, now 79, grew up listening to as a Virginia youth. "A Distant Land To Roam: Songs Of The Carter Family" is Stanley's tribute to country music's beginnings. Conversely, Cash's "American V: A Hundred Highways" seemingly marks the end of original recordings from one of music's last pioneers, as "V" is the last in a series of masterpieces Cash recorded with producer Rick Rubin for Rubin's American Records label. Cash sang with a warrior's voice earlier in the series, as he had something to prove, but this final record is more of the last, gasping breathes from a gallant knight whose time had come. Stanley still walks country music's landscape as one of its last kings, and on "A Distant Land To Roam," Stanley does his loyal subjects proud.

See the full reviews from A/V Corner at www.cpumag.com/cpusept06/AYL

DVD Byte

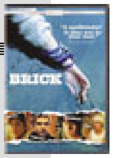
August 1

V For Vendetta

The Witches Of Eastwick

A Fish Called Wanda: Deluxe Edition

Curb Your Enthusiasm: The Complete Fifth Season



August 8

Inside Man

Brick

Ultimate Avengers 2

Sealab 2021: Season Four

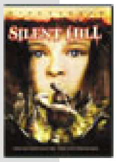
August 15

Apocalypse Now: The Complete Dossier

Surface: The Complete Season

The Simpsons: The Complete Eighth Season

Scary Movie 4



August 22

Silent Hill

Dances With Wolves: The Extended Cut

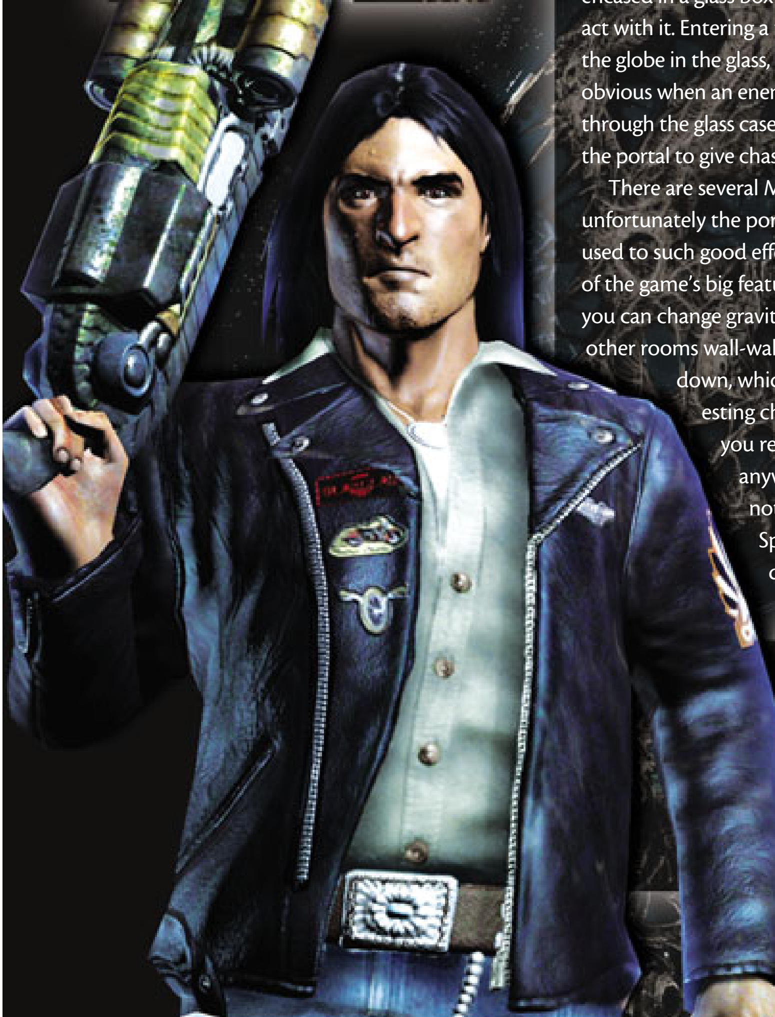
Poseidon

House: Season Two

PREY™

Worth The 11-Year Wait *-by Dr. Malaprop*

$49.99 (PC); $59.99 (360) (Add $10 for Limited Editions) • ESRB: (M)ature • Take 2 Interactive • www.prey.com



In Prey, you will play as Tommy, a young Cherokee auto mechanic who's ready to get off his reservation ASAP. As the game begins, you catch a glimpse of his dislike for Cherokee traditions. A few real-time minutes later, the roof of the bar is blown off and Tommy, his grandfather, and girlfriend are abducted by the traditional alien spotlights. He awakens inside an alien spaceship with girlfriend and grandfather on a gruesome abattoir-style body-part processing line. Tommy is freed, his grandfather passes into the next world, and his girlfriend needs rescuing That's the key plotline in a nutshell. The narrative fleshes out plenty of detail, but it's obvious where some of the plot elements come from. Plot holes aside, the game provides plenty of motivational detail and background.

Prey's portals, gravity, and death features are design areas where the developers worked hardest to avoid a me-too FPS. In one memorable sequence you enter a room to find a globe encased in a glass box but without a way to interact with it. Entering a nearby portal places you on the globe in the glass, which becomes patently obvious when an enemy walks up and peers through the glass case at you before jumping into the portal to give chase.

There are several M. C. Escher moments, but unfortunately the portals are not consistently used to such good effect. Gravity is another one of the game's big features. By hitting a switch, you can change gravity in some rooms and in other rooms wall-walk sideways or even upside down, which really makes for an interesting change in perspective when you realize that an enemy can be anywhere in a room. Last but not least is the Death (and Spirit) Walk feature. Upon death you pass into the Death Walk minigame where you have a limited time to shoot red or blue wraiths to recharge your health and spirit. Upon being sent back to life, you start out where you died. This feature removes a lot of the frustration encountered when you're forced to replay the same level repeatedly a la Far Cry. The Spirit Walk mode lets you take your bow and arrow to take out enemies, but more importantly solve level puzzles.

The game is built on the Doom 3 engine and looks very good on both the PC and 360; unlike Quake IV on 360, Prey doesn't suffer from bogged down frame rates. In-game graphics look superb, but some enemies may look like they're from Quake IV. There's not a huge selection of weapons, but that's not a limitation in Prey; the weapons have a good feel and have enough features to keep you entertained. The AI is average, but we expect more in the age of Half-Life 2 and F.E.A.R., which are benchmarks for good enemy AI. Level design is above average (though in some cases absolutely inspired) and may bring about a case of motion sickness in some. Tommy's profanity doesn't add drama to the story, and the developers could've improved the game by using less dialogue (and better voice acting) on his part. A game with so many innovative qualities would've benefited from a more robust multiplayer mode, but basic Deathmatch and Team Deathmatch is all you get. Expect to complete the single-player game in less than 14 hours; a stronger multiplayer mode could have made Prey a long-term contender.

Criticism aside, Prey disembowels the summer game release doldrums with innovative FPS action, and big kudos go out to Take 2 for not slotting the game into an overcrowded holiday release schedule. The 360 version looks superb on a widescreen TV, but we found the text very hard to read on a standard 27-inch. Just a thought in case you need to choose. ▲

TITAN QUEST

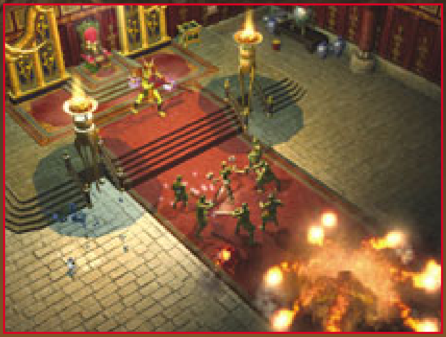
Greeks Mythology Meets Diablo *-by Dr. Malaprop*

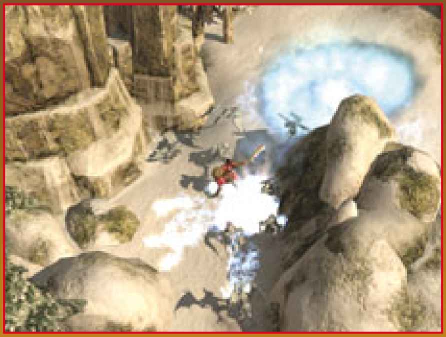
$49.99 (PC-DVD; Xbox) * ESRB: (T)een • THQ • www.titanquestgame.com

We would forgive you for rolling your eyes at yet another Diablo clone, but make no mistake: Titan Quests' revisitation of Diablo's iconic gameplay brings the full addictive quality of the original to a whole new generation of PC hardware. TQ may seem like an easily forgettable copycat title, but it holds its own against Blizzard's illustrious classics by virtue of stunning graphics, seamless environments, a seemingly endless variety of units, strong Greek mythology-based narratives, a robust map editor, and addictive hack 'n slash, action-based RPG gameplay.

The Titans are back, and they've caused the non-humans in the world to go bezerk. The premise is simple, but well-written for a game of this ilk. (The script is written by "Braveheart" writer Randall Wallace.) Character creation is plain (name and gender), but you'll have time to customize your character as the game progresses. The 3D isometric view of ancient civilization is stunning from the start. Every stalk shifts as you wander through a field of wheat, the day and night cycles as the appropriate shadows are cast, and details abound everywhere you look. Unlike Diablo, there isn't a tile-based random generator, so every little piece of the environment as you make your way through Greece, Rome, and Egypt has been lovingly crafted.

We do have some criticisms for Titan Quest: sluggish frame rates on even a high-end rig, obvious lack of innovation, linear missions, carpal tunnel-inducing mouse button clicking, and inability of inventory management systems to automatically allot space to items without intervention. None of these issues will prevent the just-five-more-minutes quality of gameplay, which speaks volumes about the game. If you loved the Diablo games and want an incredibly attractive and addictive gameplay experience along the same vein, Titan Quest has your name written all over it. The included full-featured map editor guarantees a robust community of new mods for the game, which should keep it on your hard drive for a long, long time. ▲





CHROME HOUNDS™

A Hardcore Mech Fan's Wish Come True

-by Chris Trumble

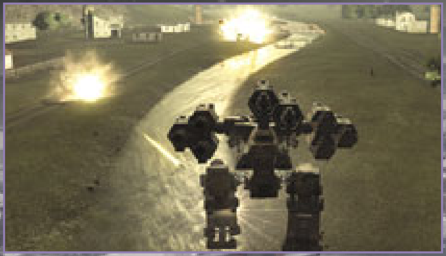
$59.99 (360) • ESRB: (T)een * Sega • www.chromehounds.com

There have been some pretty cool mech combat games on consoles over the years, starting with Activision's MechWarrior for the Super NES in 1992 and including of course Microsoft's MechAssault games for the original Xbox. But it's safe to say there aren't many console games that can match Chromehounds' blend of strategy, in-depth customization, and online team play.

In Chromehounds, you pilot mechs that move and feel like the gargantuan weapon-toting machines that they are. And unlike some mech games with limited customization options that follow a pretty static upgrade path, Chromehounds gives you a boatload of parts and puts you to work building a mech that fits your playing style (or your team's needs). You start by choosing the three main components of your mech (its chassis, cockpit, and generator), which in turn determine how fast and maneuverable it will be and what its weapons payload can be. Then you outfit your build with guns, rockets, and other accessories, keeping in mind that there are six main mech types in the game, each with special characteristics: soldier, scout, defender, heavy gunner, sniper, and commander.

The single-player campaign mode is largely forgettable, but it does a nice job of preparing players for the real challenge, which of course is online play via Xbox Live. You can participate in quick pick-up battles online or you can join the cool, persistent Neroimus War, in which three teams struggle for control of territory and, therefore, resources. The Neroimus War ends every two months or each time one team bests the other two, whichever comes first.

Chromehounds isn't for everyone, but dyed-in-the-wool mech fans will find plenty to like here. ▲



SHADOWGROUNDS
WWW.SHADOWGROUNDSGAME.COM

A Fond Smash TV Meets "Aliens" Experience *-by Dr. Malaprop*

$29.99 (PC) • ESRB: (M)ature • Meridian 4 • www.shadowgroundsgame.com

Shadowgrounds has been out for a few months via Steam but only recently got a retail box release. The game borrows liberally from sci-fi games, mixes in an old-school top-down action, blends in some light tension from "Aliens," and tosses in a dollop of horror for good measure. You play the role of corporate senior mechanic Wesley Tyler. As you work on a car, things go dark and you're called upon by your boss to get out and fix the problem. After that things escalate quickly and you're called upon to step up. (You'll want to put on your headphones to better absorb the game's atmosphere.)

Much like "Aliens," Shadowgrounds introduces a well-balanced combination of tension and action. However, as serious as it tries to be, the cut scenes/dialogue comes off unintentionally campy. But that's OK: The battery-powered flashlight and arsenal of weapons you discover along the way do plenty to keep you focused in combat. The usual assortment of weapons—a minigun, shotgun, flamethrower, and rocket—are available, but a nice touch is that each weapon has a modular upgrade path to wreak even more damage to enemies and the environment.

The price gives you more than the expected budget gameplay experience. And, yes, Shadowgrounds has its flaws (poorly placed post-death spawns, omission of Internet co-op mode, overly easy gameplay, and weak friendlies AI). However, at $29.99, we're willing to overlook most of them. Now, we'd love to see developer Frozenbyte port Shadowgrounds to Xbox 360 Live Arcade with a few fixes, including four-player co-op via the Internet. ▲

NINTENDO DS™ Lite

A Pocket-Friendly Handheld Fashion Accessory

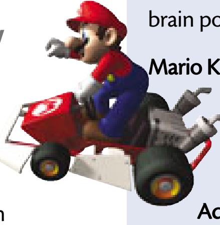
$129.99 (White) • Nintendo • www.nintendo.com/systemsds • CPU Rating: ●●●●

Much pessimism accompanied the 2004 release of the Nintendo DS in the face of the Sony PSP's superior hardware specs. Many, including us, felt the touchscreen and the use of smaller dual screens was gimmicky. Furthermore, the original DS looked ungainly alongside the svelte PSP. However, we were wrong: The DS eventually spurred some very creative games and picked up in popularity. The DS Lite saw its Japanese launch in March and arrived on these shores this summer.

The DS Lite's features and screen size remain identical to the original, but Nintendo has redesigned the hardware. The new DS clamshell design goes from frumpy to jet-set stylish in this iteration; it's approximately 20% lighter, takes up 42% less space, features visibly brighter screens (with four brightness settings), and improved battery life.

Nintendo has moved the microphone to the center of the unit and the On/Off switch to the unit's right side where it's less prone to accidental use. The speaker sounds as robust as the original, and the D-pad shrinks slightly but not uncomfortably. As with the original, you can expect a variety of colors: Only Polar White (a glossy coat which bears similarity to the iPod) is available in North America right now, but there are three colors available in Japan and black and white in the UK.

You won't be embarrassed to sport your DS Lite in public because it's stylish and quite chic. Buy one for yourself and your significant other and be the envy of other couples as you bond over one of the many innovative DS games. In the near future you'll be able to use Opera 9 to browse the Web from any Wi-Fi hotspot (see the "Software" sidebar) using your DS, which makes this more than just handheld gaming hardware. Pick one up and see for yourself. ▲



SOFTWARE

Brain Age. Train your brain with a variety of problems that flex your brain power.

Mario Kart DS. Simple to play and superbly balanced racing games with full Wi-Fi support.

Advance Wars Dual Strike. This deep and very entertaining strategy game is already a year old, but don't let that dissuade you. It features a solid campaign and tremendous multiplayer value.

The Legend Of Zelda: Phantom Hourglass. Nintendo's seminal RPG adventure will be hitting the DS during the holiday season in all its cell-shaded glory. Another anticipated RPG is Square Enix's Final Fantasy III due in October.

Nintendo DS Browser. Think Opera 9 Internet access from anywhere you can get Wi-Fi. The lower screen shows you the full-page and the upper screen zooms to your specific area of interest. Out in Japan and coming soon to North America.

Specialized Game Keypads

The Fang vs. The Warrior

We've looked at and extensively tested game-specific keyboards, such as the Ideazon MERC and Wolfking Timber Wolf (it used to be called the Wolf Claw), but as nice as those units were, we never wanted to part with our fave Microsoft or Logitech keyboards for daily use. Enter the Fang and the Warrior. Both game controller-specific keypads were basically ripped from their full keyboard predecessors and will bring hours of comfortable gaming goodness along with more efficient control in your games.

$34.99
Ideazon
www.zboard.com/experience/fang
CPU Rating: ●●●●◖

Fang

The 49-key Fang eats up less desktop real estate than the circular Warrior (below). It eschews the Warrior's function keys for specialized keys, such as Quick Save/Load, Reload, Use, Pause, and so forth. It also includes a broader set of multimedia controls for those that don't already have keyboard support.

Whereas the Warrior's Spacebar is located on the right side of the circle, the Fang's Spacebar is located along the right side of the unit—at the point where your thumb hangs off the side. Some of the typical ZXC functions have custom keys positioned for easy use with your pinky finger. We initially found these a bit awkward to use, but got used to them eventually. Alternatively, you can use the included Z Engine (the v2 beta was available at press time) to map keys to your heart's content and even print out quick reference guides. ▲

$34.99
Wolfking
www.wolfkingusa.com/prdts_wolfking.html
CPU Rating: ●●●●

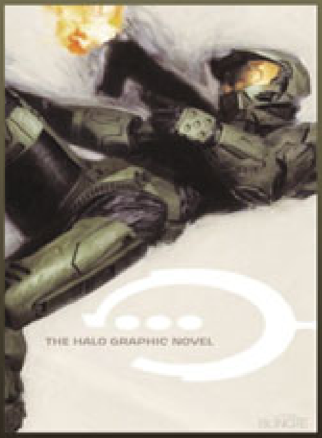
Warrior

Wolfking's full-sized gaming keyboard had previously only been available via ThinkGeek.com or the company's Singapore office, so many gamers will be delighted to learn that Wolfking now has a North American presence. Our tests with the 55-key standalone Warrior were positive. Think Timber Wolf sans keyboard with some additional keys, including two for volume control and one for the ESC key.

We would've liked to have had the S key ridged because until we got accustomed to the hardware, our fingers kept dropping from the ASD keys to the sizeable ZXCs. Otherwise, the Warrior behaved superbly. Like the Fang, it can cater to righties or lefties. The biggest omission was the lack of customization software, which you can accomplish directly in-game but is easily forgettable if you switch extensively among games. ▲

HALO

Graphic Novel



It was our intent to secure a copy of this product and give you an in-depth review of the writing and art within, but these plans were foiled by some kind of dark vortex which apparently devoured every copy of the book on the planet. OK, maybe not, but we were unable to find the HGN at any local outlets, even though we were willing to wait well past the stated ship date. Our only consolation was hearing just before press time that even the guys at Bungie hadn't received finished copies.

So instead, let us just say that the HGN is a 128-page slice of the Halo universe that as nearly as we can tell will very nearly make any true Halo fan's head explode. Four original stories that complement those in the games and novels, crafted by several superlative comic book artists (two words for ya, fanboy: Simon Bisley), and a mini-gallery of original Halo-themed art. All this for $24.95—or $14.95 if you're smart enough to buy it on Amazon.com instead of waiting for local retailers to get some. ▲

$24.95 • Marvel Comics
www.marvelcomics.com

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- **Smart Fan 3mins on after shut down**

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Tell Me A Scary Story, Daddy. Tell Me About Computer Viruses.

by Barry Brenesal

My child, the origins of computer viruses are shrouded in controversy. Some say the first one to appear outside labs was Elk Cloner, created in 1982 by a 15-year-old Rich Skrenta, now CEO and co-founder of Topix.net. It inserted itself into the Apple-based DOS 3.3 OS and spread itself much as you'd expect at the time, by floppy disk. But I hold that the first computer virus to show up in the wild occurred in 1975 on the Univac 1100, and the name of the beastie was, appropriately enough, Animal.

John Walker was working for a large engineering firm and had written a much-updated version of a game called Animal. In it, the computer asked you to select an animal, issued a few questions, and then made a guess at what animal you chose. It incorporated error-correcting algorithms based on previous input—so, in effect, it learned as it lost. After getting many requests for it, Walker created a subroutine called Pervade that looked for any available computer directory that contained an older version of Animal, or no version at all. It then overwrote the older version on the newer one or installed a copy for the first time. With data tapes being traded back and forth, this self-replicating form of Animal began to pop up everywhere: the first Trojan horse, though without malicious intent. And because entering a directory name on a Univac usually ran the latest executable, some programs that included this command were suddenly telling computer engineers to "think of an animal."

Animal was so small that it wasn't overloading systems, and according to Walker, the Univac community accepted it as a good joke. No changes were made to the Univac OS to get rid of it. When Animal encountered a new OS later on, it simply stopped working, and Walker never issued another version of it.

Now that we have that out of the way, let's return to 1982, and Elk Cloner. Again, it wasn't malicious, though its payload, which appeared every 50th time an infected floppy was rebooted, was a screen displaying:

Elk Cloner: The program with a personality
It will get on all your disks
It will infiltrate your chips
Yes, it's Cloner!
It will stick to you like glue
It will modify ram too
Send in the Cloner!

Clearly, Skrenta had no future in poetry.

It wasn't until 1986 that viruses hit the PC. The brothers Basit and Amjad Farooq Alvi of Lahore, Pakistan, supposedly wrote ©Brain to determine how widespread software piracy was in their nation. Another explanation states that they created the virus to protect some medical software from piracy. Whatever the reason, ©Brain moved the contents of the DOS boot sector to another location, marked it as bad, and put itself in its place. A message appeared in the code, usually with some variant including the authors' names, phone numbers, and a suggestion to contact them for vaccination against the virus. The Alvi brothers were supposedly more than a bit surprised when they began receiving phone calls from all over the world demanding that they explain how to remove their virus. Currently they run an ISP, amusingly called Brain, Limited.

There's plenty more to mention, but let's end with perhaps the most significant early boost to computer virus production of them all: A small bunch of kids attending the National Mathematics High School of Varna, Bulgaria, in the late 1980s and early 1990s used Pravetz 82 computers to create malicious viruses that outdid one another in clever design. One of the earliest was the first polymorphic virus, Dark Avenger. It was followed by Commander Bomber, Jerusalem, Pakistani Brain, Frodo, and Michelangelo, among others. An estimated 160 viruses were supposedly released upon the world from Bulgaria, but contrary to media predictions at the time, these didn't bring the computer world crashing to its knees. Instead, they demonstrated ingenuity in developing new methods of infection, stealth, and encryption that became an encouragement to similar malcontents everywhere. The Bulgarian kids have since grown up, but their legacy remains behind to trouble computer users—and to invigorate the antivirus software industry. ▲

Wax nostalgic with Barry at Barry@cpumag.com

Barry Brenesal has written more than 1,000 published articles and reviews on electronic technology since 1987. His first personal computer was a Radio Shack TRS-80 model 100. It was last seen functioning as a boat anchor.

. . . this self-replicating form of Animal began to pop up everywhere: the first Trojan horse . . .

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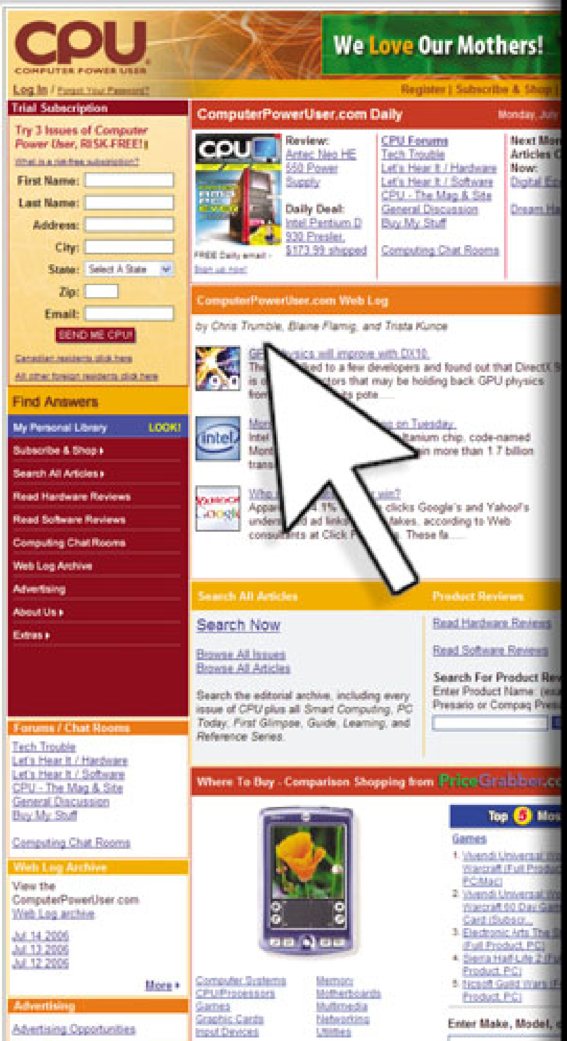

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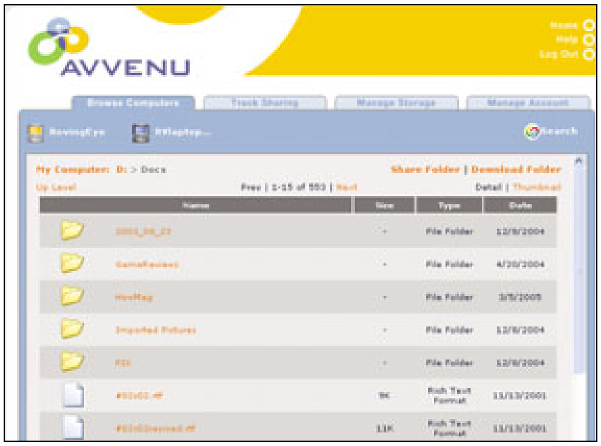
Software Tips & Projects

Remote Access On The Cheap

Accessing your home computer from afar used to be a minefield of obstacles that only an obsessive PC geek could enjoy navigating. In the past year, however, things have changed radically, as more user-friendly, Web-based services such as pcAnywhere and GoToMyPC finally make remote access more usable—and expensive. This month we explore some of the free and novel alternatives to the usual remote access programs to get you connected to home on the cheap.

Easy Avvenu

If all you really need is the ability to access your hard drive and download data files to a remote location, then the free version of Avvenu (www.avvenu.com) is a good program to try. This service puts a small memory resident client on your home PC that stays connected to the Web-based Avvenu.com, where you can log into your account and literally browse your home PC from any machine with a browser. We won't detail the installation procedure here, so you'll need to go to the Avvenu.com site to start an account and download the necessary software. As part of the setup procedure, Avvenu asks you to name your home computer. With your home computer named, you can log into Avvenu.com from any machine and click the name of your home PC in the Browse Computers tab to open your entire My Computer folder.



Although slow, Avvenu is a free service you can use to access your hard drive from any connected PC via the Web browser.

Basic Avvenu is sluggish, so here are a few tips for smoothing out the experience.

Avvenu accesses your PC initially at the My Computer level, so you'll have to drill into several drives and folders before you find what you want. Ideally, you'll want to create a folder on your hard drive to keep the latest versions of files you'll be accessing from afar. Notice that the browser-based Avvenu interface can only show a limited number of items per screen, making navigation cumbersome in cluttered folders, so try to keep your critical files in a small folder and direct Avvenu to open it by default. To do this, log in to your Avvenu account, click through to the drive or folder you'll access most often, and click the Set As Default Page link on the lower-left side of the screen to make this your default entryway to that PC.

One weakness of Avvenu is that it accesses your entire PC, all drives and folders, as if you were opening My Computer on your Windows Desktop. To keep any sensitive folders from appearing in the Avvenu system, give them a "hidden" status on your home PC. On your host PC, right-click the folder you want to hide from

WinXP Tip Of The Month

When your hard drive starts getting sluggish or error-prone, Windows veterans might want to reach for that old standby Chkdsk to do a quick scan of their drive for any possible errors. But where is it in Windows XP? To check for errors in WinXP, right-click a drive in My Computer, select Properties from the drop-down menu, and click the Tools tab in the next window. Under Error-Checking, click the Check Now button. You can also access the Chkdsk command from the command line. First click Start, Run, type **cmd** in the Open field, and click OK. In the Command window, type **chkdsk /?** to get a list of command line switches. (*NOTE: Some options apply only to disks in FAT32 or NTFS formats.*)

Registry Tweak Of The Month

Does you PC fail to turn itself off when Windows XP shuts down? In some cases this has more to do with your system BIOS than it does with Windows. For this problem always start with the BIOS and try different power-saving settings or look for any settings that refer specifically to powering down. If none of this works, then try this Registry tweak: First click Start, Run, type **regedit** in the Open field, and click OK. Go to the HKEY_CURRENT_USER\CONTROL PANEL\DESKTOP key, double-click the PowerOffActive value, and type **1** in the Value Data field.

Avvenu and click Properties. In the General tab under Attributes, check the Hidden box and then click OK. This folder will now be invisible to the Avvenu remote access directories. You also want to make these hidden folders visible to you on your own home PC, however. In any Windows Explorer window, click Tools and select Folder Options. In the Folder Option window, click the View tab, the radio button for Show Hidden Files And Folders, and OK.

Avvenu makes it easy to download a file from your host PC to the remote computer or to "share" a file or image with a third party by sending an email invitation that links someone else to your file, even if they don't have an Avvenu account. For grabbing the occasional file left behind, Avvenu is great because it eats a negligible 13K of system resources when its Agent.exe program is resident in the System Tray. You can let it load automatically at boot and know that whenever your PC is on you can grab any file from your hard drive at any time.

LogMeIn

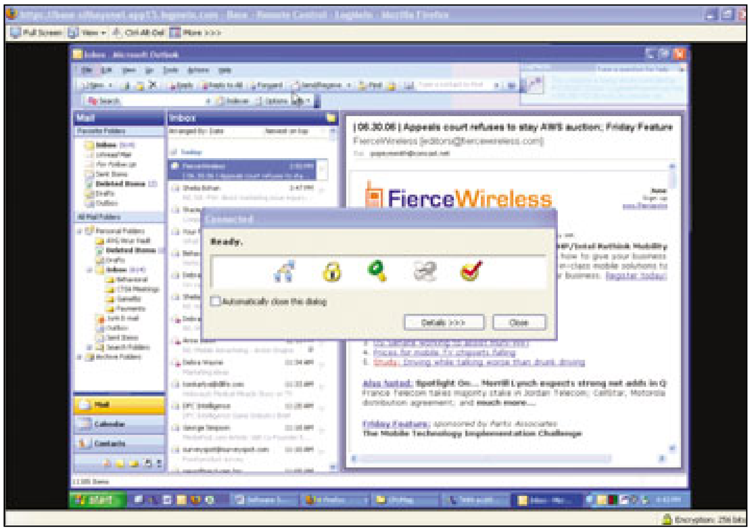
Sometimes getting a file isn't enough and you need to run a program on your home PC, like loading Outlook in order to consult your contacts or calendar. For cheapskates like us who are always looking to avoid that monthly fee for anything, LogMeIn's free version is a good find. LogMeIn.com offers tiered services, including a fee-based Pro version with full copy and paste and file-transfer functions. When you go to the site and download the client for the host PC, you get a free month of Pro service that then backs down into the more limited free tier after that.

The free version only gives you remote access to your Desktop via a browser plug-in on the remote PC. This approach is great if all you need to do is grab a contact you left behind or consult a document you didn't think to pack. The free version also has a basic copy and paste function that transfers limited amounts of data between host and remote PC screens. In order to get this functionality, sign into your LogMeIn.com account and click the computer name you want to access. In the Remote Control option, click Go and you will see an options screen that includes a checkbox for synchronizing your clipboard. This is the only time you'll see this option, so be sure to check it to get the cut and paste functionality. Now all you need to do is highlight and copy document text in an application on the remote or host PC. LogMeIn retains that clipboard information when you move from the host to remote screens, so you can copy text in a document on the host and paste it into a document on the remote PC and vice versa. You can't copy full files to the clipboard, however.

If you didn't check the clipboard synchronization option when you first logged in to the Remote Control, you can fix this by adjusting a Registry key. First click Start, Run, type **regedit** in the Open field, and click OK. Go to the HKEY_CURRENT_USER/SOFTWARE/LOGMEIN/CLIENT/OPTIONS key and look for the subkey named for your host PC. Right-click the name and select Delete. Close Regedit and restart LogMeIn. When you go into the Remote Control, you'll have the opportunity to choose your options again.

Even though the Pro upgrade adds easy file transfer and copy and paste routines to this smooth remote access program, here's a way to use the free version of LogMeIn to transfer material to your remote PC: Just use email. Load Outlook remotely via LogMeIn and email the file you need back to yourself. If you're using an email client on the remote PC to log into your home email server, the file will show up as an attachment on the remote PC. CPU

by Steve Smith



LogMeIn Free offers basic remote access to and control of your home PC for no charge.

Infinite Loop

Sugar-Loving Bacteria Power Fuel Cells

Scientists at the University of Birmingham in the UK are feeding Escherichia coli bacteria chocolate "waste." Why? Because the bacteria love sugar and can produce enough hydrogen after eating it to power a fuel cell. But that's not all: These bacteria can also help recover valuable metals from a car's catalytic converter. If only we could generate power from our chocolate-eating habit. ▲

Source: www.newscientisttech.com/article/mg19025546.000

Warm Up To Penguins

A Look At SuSE 10.1 & XGL

The release of Novell's new SuSE 10.1 distribution has caused a lot of interest in the Linux community for a variety of reasons. One of the flashiest reasons for interest in the distro among users is the inclusion of a 3D desktop option with the use of XGL. There are many other characteristics of this distribution, however, that also aim at improving the desktop experience.

There are three main versions of the distribution available, including the regular commercial SuSE Linux version ($59.95; www.novell.com/products/suselinux), a SuSE Linux Enterprise Desktop 10 version ($50 per license; www.novell.com/linux; offered in a prerelease at this writing), and the free OpenSuSE (www.opensuse.org) version. For this article we'll focus on the commercial SuSE Linux version, but we'll also include some notes for those who would prefer to try OpenSuSE, which particularly focuses on support for a 3D desktop.

Obtain & Install SuSE

You can purchase the commercial SuSE version directly through Novell or through one of its resellers and distributors. Links for both are available at the SuSE Linux Web site. If you don't want to install and initially configure your own system yourself, there are systems for sale preinstalled with SuSE Linux desktops. While major hardware retailers have been slow to offer this option, many smaller retailers do give you the option to request a version of Linux be installed before the machine ships to you. Because SuSE is a well-known Linux distribution, it's often among the options that vendors offer.

If these options aren't possible for you or you just want to download OpenSuSE to try it, you can typically contact a local LUG (Linux User Group) to ask for assistance or inquire when the LUG's next "installfest" will be. You can usually find a local LUG group by searching the Web for "LUG" and your city's name or the city closest to you.

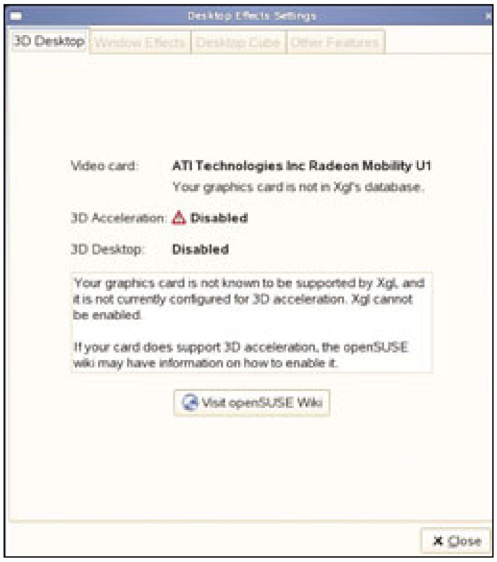
For this article we'll focus primarily on SuSE's features, but it's worth taking a quick look at the installation process. With each distro release, Novell has attempted to fine-tune the install process, allowing for a larger level of control that advanced users crave while also giving beginners the chance to step through the installation faster and with less stress. Although it's still not perfect, the process has become fairly streamlined and easier to recognize the aspects of the distro that you need to configure and those that are already fine. Moving a good portion of these tasks to later in the install process after the machine reboots has made what used to be a long, somewhat-exhausting process into a much more manageable one.

The main thing to keep in mind during installation is that it's a good idea to look over the distribution's default settings and the settings that the installer gathers after scanning your hardware. You can change many options with a single click, including turning the firewall on or off. Typically, though, if you aren't sure about something, it's safe to just leave it at its current setting, as you can always change it later.

SuSE & XGL

What most Linux users are most interested in with this latest SuSE release is its XGL features, as they relate to the 3D desktop for Gnome. Some users believe this is the default desktop for the release, or at least that it's installed by default, but neither is the case. Instead, you need to make sure that you add the compiz, xgl, and libwnck packages. Doing this after the installation is finished is fine. Once you do so, you need to determine if you can run XGL, and if so, set it up.

To set XGL up, navigate to Desktop, Control Center, and then Desktop Effects Settings. The first thing you should see is an indication if the XGL database (as shown in Fig. 1) has recognized your video card. If the video card isn't recognized, it's possible that your card doesn't support 3D acceleration, which is a feature that's required. You won't be able to configure the XGL option in the distro until the database recognizes your card. If you're having trouble getting your card recognized, see the "XGL Hardware Advisory" section on



Video card: ATI Technologies Inc Radeon Mobility U1
Your graphics card is not in Xgl's database.
3D Acceleration: ⚠ Disabled
3D Desktop: Disabled

Your graphics card is not known to be supported by Xgl, and it is not currently configured for 3D acceleration. Xgl cannot be enabled.

If your card does support 3D acceleration, the openSUSE wiki may have information on how to enable it.

Fig. 1. If your video card isn't configured for 3D acceleration and doesn't have XGL support, you may not be able to use it to access and view SuSE's 3D desktop.

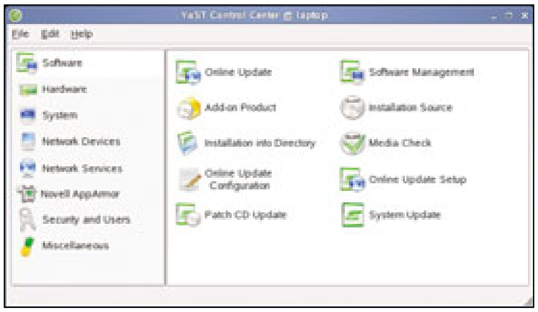


Fig. 2. This image shows SuSE 10.1's incarnation of YaST, a configuration utility especially helpful to administrators.

the XGL page (en.opensuse.org/Xgl#Hardware_Advisory) at the openSuSE Web site. The advisory contains information that may help you determine if you need to add proprietary drivers to your system, as well as data concerning finding other fixes. (If you are unsure which card you have installed, try using the hwinfo –gfxcard command at root to find out.)

If you find that your card isn't supported, the issue probably involves the card lacking 3D acceleration features or that the card is known to have substantial problems with XGL. If this is the case and you still want to use the XGL feature, you'll need to consider purchasing another card. (Double-check first that you have the latest version of SuSE installed.) The information in the "XGL Hardware Advisory" section may help you in selecting a new card if you go this route. Additionally, there's more information on this topic in the "Supported and Unsupported Video Cards" section on the "Using XGL On SuSE" page at en.opensuse.org/Using_Xgl_on_SUSE Linux. It's possible this page will also have new information that wasn't available as of this writing.

If you have a video card that supports XGL, the following sections on the "Using XGL On SuSE" page discuss whether 3D acceleration support is enabled or disabled. If this feature is enabled on your system, you can skip the page's discussion on how to enable it. If the feature is disabled on your system, however, the "Using XGL On SuSE" page discusses how to enable 3D acceleration for many popular video cards.

Once you have 3D acceleration enabled, you have the option of enabling the 3D desktop. If you do this, you'll need to log out of your GUI session completely and then go back to the GUI login prompt and log back in. You should then see the XGL desktop.

Other SuSE Highlights

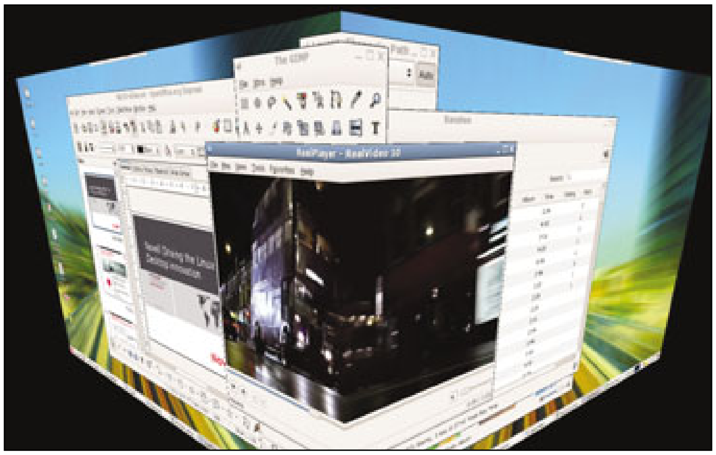
It's impossible to address all the features in the SuSE 10.1 release here, but some of the other highlights beyond the 3D desktop and XGL features include SuSE's popular YaST configuration utility (shown in Fig. 2), which is an administrator's one-stop shop for configuring a SuSE system. Those who install the commercial SuSE version will also find various Web browsers bundled, including Firefox and Opera. If you're interested in multimedia features, support for VoIP and the inclusion of RealPlayer and MainActor (a professional video-editing tool) are included and should help to enhance the desktop experience. Notebook users should appreciate Intel Centrino support, and mobile device users will like that Bluetooth devices are automatically recognized in this release.

A wealth of additional software is also included on the six CDs and one DVD that make up the package. Everything from OpenOffice.org 2.0 to educational tools such as Kiten (for learning and working with Japanese Kanji characters) is here. You'll also find antivirus (AntiVir), antispam (SpamAssassin), and such other security tools as Novell AppArmor included, as well as support for the XEN virtualization tool. Mono (the open-source Linux implementation of .NET) is also more heavily integrated with tools such as Beagle for desktop search and F-Spot for editing images.

Another handy aspect of the distro is that Flash and Java are already installed and integrated into such programs as Firefox, saving you the hassle of having to set up the programs to do this after you install the distro. Just make sure you specify that you want these items when you are selecting your software during installation.

Overall, SuSE 10.1 is a smooth, professional product with well-organized menus and an interface specifically tweaked for those moving to Linux from Windows. Such adjustments include a customized Gnome look and feel, with many adjustments having been made as a result of Novell's Better Desktop initiative (www.betterdesktop.org), which involved numerous usability tests to see where users were running into problems utilizing many common Linux applications. The project then shared its raw data so that any open-source developer could turn around and benefit from it. We'll likely feel the results of the initiative greater in further releases down the road and echoed in projects throughout the open-source community.

by Dee-Ann LeBlanc



This image from OpenSuSE's Web site of a 3D "cube" for rotating desktops provides an example of a 3D desktop in action.

Shavings From The Rumour Mill

by Mike Magee

The Desktop Is Not Dead, Long Live The Desktop

There's a widespread perception that the chipmakers are also fostering that desktop PCs are a thing of the past and notebooks are the future. But as an enthusiastic user of laptops since (believe it or not) 1986, there's no way I'm going to dump my desktop now or in the future.

In the last couple of years notebook design has improved a great deal. The screens are better and mobile graphics support is much better, but notebooks still don't match a fully featured desktop in all sorts of ways.

At home I've resisted the move to dump my nice 21-inch CRT screen in favour of an LCD monitor. OK, it's a beast that requires me to drop the beer for two days beforehand and get fit enough to move it if I have to, but the resolution is way better than anything I've seen or can afford to buy.

My desktop has got loads of space to add extra memory if I want to, as well as expansion slots for hard drives and for add-on peripherals. It's there for as long as the AC stays up and the ADSL line stays connected, and it's nowhere near as noisy as desktop systems used to be. What's more, the keyboard is comfortable to use while the mouse is not one of those pesky trackpads but a thing with a tail that responds well when I want it to do what I want it to do.

That's not to say I don't like my notebook. I love it. If you're a regular reader of this column you'll know that I waxed lyrical about a Panasonic Toughbook a few years back; it uses a 900MHz Banias ULV microprocessor, and I'm still using it. Why? Because it's got excellent battery life and it's light as a feather. Even the power brick is dinky and light. It's three years old, but I can coax nearly four hours out of the one battery as long as I turn the LCD screen down and keep my application software mean and lean.

That just isn't the case with the successors to the Intel Banias chip and to AMD's Turion, either. I've been disappointed with their battery life—extra features come at a cost and they always seem to cost battery life. I regularly tote my notebook around with me when I'm away from my desktop; if I'm on the road those extra minutes of battery life can mean the difference between meeting a deadline or not. A friend of mine learned to his cost that plugging his notebook into a London Heathrow Airport power supply brought him to the attention of the Metropolitan Police who told him to unplug it, now, or face prosecution for stealing electricity.

As I write this, Intel is on the verge of releasing its Conroe range of desktop CPUs, and a few weeks later it's expected to introduce the notebook Merom processors, too. I'm always curious about new processors, and I'll be interested to see how new Conroe desktops perform with Windows XP before a Vista overhead is forced upon them sometime next year.

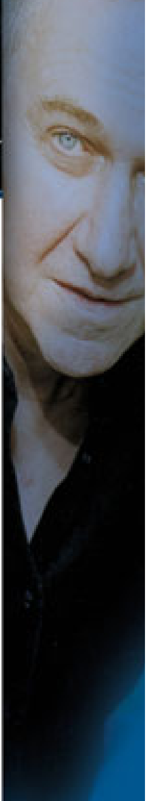
Advances in desktop design mean that it's not going to be that much of a nightmare to upgrade to a Conroe system. I won't be an early adopter but will wait three or four months for prices to fall before I plug my existing drives into a new chassis and board. I guess that a Conroe with a load of memory will run my version of Microsoft Word for Windows 2.0 extremely well indeed.

I'm also moderately excited about the Merom notebook processors, but as always I will be watching to see how long the pesky battery life will be for real-world systems and how light notebooks will be, as well. I don't know how long it will be before my Banias machine gives up the ghost but if there aren't any Merom breakthroughs in battery life, I suspect I'll still be using it until it finally falls over.

And I'll be continuing to use the desktop where it belongs, right on the top of my desk, with every bell and whistle I can pack into it. ▲

Send rumours to "Mad Mike" Magee at Mike@cpumag.com.

Mike Magee is an industry veteran. He cut his teeth on ancient products like the Dragon and the Japanese PC platforms long before the IBM-PC won. He worked for a corporate reseller in the mid-'80s and saw the Compaq 386 sandwich box and every GUI known to humankind. Mike decided that the way to go was the Interweb around 1994 after editing PC mags in the late '80s and '90s. A co-founder of The Register, Mike started the chip-driven INQUIRER (www.theinquirer.net) in 2001. He has contacts from top to bottom in the business, spanning the entire chain, who help him root out interesting rumours and speculation.



> Advances in desktop design mean that it's not going to be that much of a nightmare to upgrade to a Conroe system.

Wagging The Dog

by Rahul Sood

Intel Will Change The Way It Does Business

In the coming weeks and months, we shall witness as Intel morphs into a slightly different company. I believe Intel's "good ol' boy" days are gone.

Gone are the days when Intel focused on market share dominance by doing whatever it could to keep its competition at bay. Gone are the days when Intel started a price war for the sake of crushing its competition and assuming market dominance. Gone are the days when Intel publicly ignored that it even had competition.

In the coming weeks Intel will lay off a significant chunk of staff while working to transform itself into an efficient, finely tuned machine. From where I am sitting, I see Intel making some positive moves. The company should thank AMD for poking it in the eye and beating it with a stick—it was a humbling experience.

I can safely say that attitudes at Intel have changed immensely. One tiny example: Intel put a new sales exec on our account a few months ago, and this guy is insane. He calls me up and emails me constantly, keeping me up-to-date like no other. He's been preparing Voodoo for the launch of Intel's new products better than any other sales rep I have come across. This is just a taste of how the company has changed, and it's likely these kinds of shifts in attitude and responsiveness will continue.

By the time you read this, Intel will have launched its much-anticipated Conroe (aka Core 2) CPU. The reviews are very positive and rightfully so—this new processor came out of nowhere and delivers the goods. It's cooler, quieter, faster, and more efficient than any previous processor I have had the pleasure of testing.

To be honest there isn't much at all to complain about other than the whacked-out naming convention. I don't know about you, but I find the Core 2 branding to be quite confusing. Personally I would have preferred Pentium 6 or a less confusing, more logical successor to the Pentium series. Techs at Voodoo have taken to referring to Conroe as "the new Pentium."

Naming aside, Intel's new Core 2 Duo is a bloody killer processor. It seems that the desktop folks followed the lead of the company's very successful notebook design team and conjured up a winner. Intel finally realized that power is essential and can now claim overall desktop superiority. What's more, we're able to operate the high-end Core 2 processors in certain fanless configurations without any major system stress.

I recently ripped apart my desktop PC at home (a fanless system) and built a new machine based around the Core 2 Extreme processor. The first thing I did was install a few games, including Call Of Duty 2, Far Cry, F.E.A.R., rFactor, and World Of Warcrack (don't ask). I immediately maxed the resolution to 2,560 x 1,600 on my custom 30-inch display and started to run the benchmarks. I wasn't expecting too much, but let's just say I feel revitalized again; things had been getting a bit stale there for a time, and there was a point when I started to lose interest in the industry. But as you can tell, I'm pretty excited about the new Intel chip, and I'm very bullish on the new level of innovations that this platform will bring to market. AMD finally has some competition, and ultimately competition is the only thing that keeps our industry moving forward.

Speaking of moving forward, it would be a huge mistake to assume that AMD has fallen asleep at the wheel. It seems that much of the commentary I've seen in the press lately has been a little harsh with AMD; lest we forget, the company has owned the leadership position in the high-end space for years—up until a few days ago. I'm sure Intel's chief rival is working on a master plan to regain the high ground, and as it continues to eat market share it could implement a strategy that no one is expecting.

Nothing is worse for our business than complacency. ▲

Send your opinions to this opinionated guy at Rahul@cpumag.com.

Rahul Sood's love for computers started at the young age of 11. Much to the shock and dismay of his parents, he ripped apart his brand-new Apple //c and painted it red before turning it on. His parent's dreams of having a doctor for a son were shattered when college drop-out Rahul founded what is now one of the most respected high-end computer companies in the world, Voodoo Computers.

> The company should thank AMD for poking it in the eye and beating it with a stick . . .

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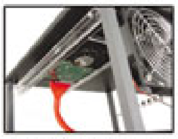

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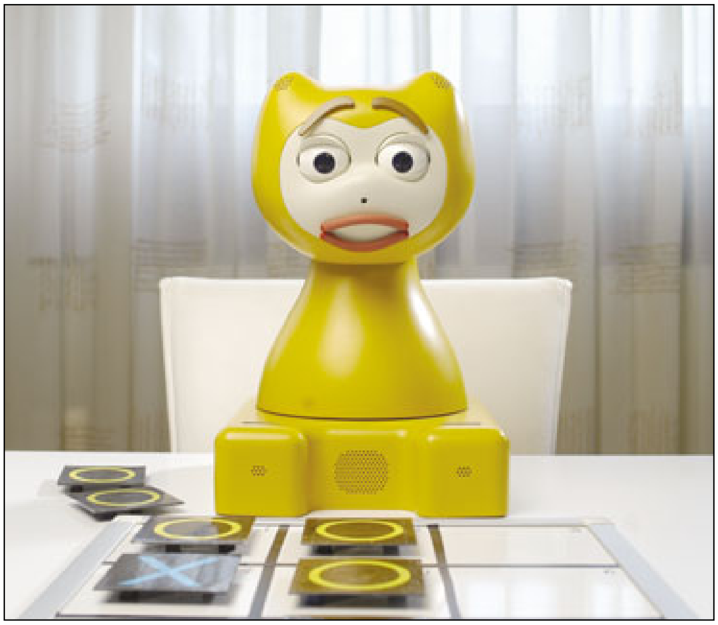
Technically Speaking

An Interview With Dr. Albert van Breemen, Leader Of Philips' iCAT Robotics Project



Philips Research snapped up Dr. Albert van Breemen immediately following his Ph.D. work on applying software technology in control systems design. van Breemen currently works at Philips Research Eindhoven, The Netherlands, as a senior scientist on user interface robots and as the Project Leader of iCAT. The project's goal, according to van Breemen, is to develop technologies for creating socially pleasant robots. For more on iCAT, see www.research.philips.com/technologies/syst_softw/robotics/index.html and www.hitech-projects.com/icat/index.php. We recently spoke with van Breemen about the project and iCAT's future uses.

by Barry Brenesal

CPU: Did you develop the idea for iCAT or was it a group proposal?

van Breemen: Let's call it a group proposal. Building a complex system like the iCAT you can never do on your own. Consider me as the driving force. I'm a robotics enthusiast, and you need somebody inside a company like Philips to really push this topic.

CPU: What was the intended purpose for the iCAT?

van Breemen: When we started to work on robotics, we didn't start with the iCAT. In 2000, we had this vision of having a mobile robot that could act as a home servant. We based it here in Eindhoven in a research lab called the Home Lab consisting of a living room, a kitchen, a bedroom, a study, a children's room, and a bathroom. We built our first robot using materials left over from all other projects, and it was called Lino. While doing some experiments with this robot moving it through the home, we noticed that when it changed facial expressions—for instance, smiling—people reacted to it. Then we had to make a decision where we would focus our research, on mobility or expressiveness, because we didn't have enough people working in robotics to manage two projects.

We ended up thinking that a lot of universities were working on mobile robots and the navigation problem. Instead, we decided to focus our attention on robotic 'faces.' It intrigued us because despite being a thing of metal and plastic, those expressions were always getting reactions. And if you can entertain people in this way, then that is the start of a business. This meant we needed a different kind of research platform. So in 2002, we decided to make a new robot for our work. It had to be light and transportable, unlike Lino, which was too heavy. And then we came up with the iCAT. It has a lot of mobility, but that mobility is entirely in the face.

CPU: You mentioned the connection between iCAT and humans being 'the start of a business.' What kinds of businesses can utilize the results of this research into how people react toward facial expressions?

van Breemen: A lot of individuals and companies are currently very enthusiastic about what is happening in the field of robotics. Some of

the greatest researchers in this field have made some predictions that within 10 years there will be a very large market for domestic robots. Europe, for instance, has just launched its own robotics platform, called EUROP. A lot of people have the feeling that something important is going to happen, but on the other hand, nobody knows at this point what the application will be. Although if you look at the present time, I think the best applications would be the vacuum cleaning robot and the automatic lawnmower robot.

We thought, 'OK, let's take about 10 years and see how the technology evolves.' Meanwhile, we know this robot is going to be in your home, and you'll, of course, want to have some social interaction with it. In order to enable social interaction, we gave it a face. When that robot communicates with humans, the face is very important. This is because, first of all, your head is your instrument to start up conversations. But you also use all kinds of facial expressions during your conversations. That's why we focused on building a robot with a face.

> Some of the greatest researchers in this field have made some predictions that within 10 years there will be a very large market for domestic robots.
>
> —Albert van Breeman

CPU: How many different, separately animated parts are there to iCAT's face? And how many ways do those parts move?

van Breemen: First of all, you have 11 RC servos controlling the eyebrows, eyelids, eyes, and mouth. We also have what we call DC motors, and they control the neck and the body. So iCAT can turn to the left, the right, and tilt its head. Besides motors and servos, we've also given it multicolored LEDs. The ears and paws of iCAT contain these. These are very important for communicating with users. For instance, if iCAT has recognized your face by using the camera in its nose, then its ears turn blue. That signals recognition to the user. iCAT can also ask a user a yes/no question, and you can touch its paws containing red and green LEDs to give an answer.

CPU: It doesn't have speech recognition for simple yes/no user input?

van Breemen: It has that, too, but touch is really reliable. It's important to remember that iCAT is currently not a consumer product. It is a research platform. What we want to do is research individual robotic technologies. Although there has been a lot of progress in speech recognition, building a robotic system that understands natural language is still very difficult. So there are two reasons we've given touch sensors to the iCAT. First of all, because it is dependable, while the other reason is because if you show the robot to a user, the first thing they do is touch iCAT's ear or paw. That's very natural because it looks like, in this case, a cat, and people like to pet cats.

CPU: Playing devil's advocate for a second, would it be fair to say that when it comes down to it, iCAT exists to do nothing more than make a user feel good? That everything else—all the functionality—a computer could perform without a facial interface?

van Breemen: I don't think so, and I will explain why. What we are trying to do is build intelligent systems. And we want to build systems that anticipate the user. But in order for a system to do that, it should have knowledge about the user. Now, consider a CD player. Suppose that I want to have an intelligent CD player, so that when I arrive home from a day of hard work it will just play music that I like. Somehow, I have to teach my CD player what this kind of music is. Of course, my CD player could ask me that, but this is not the traditional interface that you expect—they don't talk to you. Another option in some futuristic visions of intelligent homes is that your home just listens to you. So you can talk to the walls or your ceiling, and the house will literally react to you. But then I've never seen anybody talking to the walls about the kinds of music he or she likes. It's different with the iCAT because it is a *character*. You just start talking to it, maybe playing a game with it. Through such interactions you may reveal that you like Madonna's music.

If you say that the interface of iCAT is only to entertain and does not contribute to functionality, then I don't think that's really the complete story. It's because of this interface that people tell something about themselves. This information is really important. iCAT's function is certainly to entertain the user, but it is also to enable conversation to pass information along to the system.

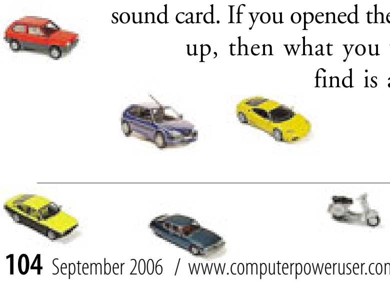
CPU: We noticed a quote on an iCAT Web site, 'Nonverbal feedback cues are essential for an implicit grounding of communication acts. In human-human like face-to-face dialogs, nonverbal cues like gaze direction, facial expressions, or head movements are frequently used to ensure each other of their mutual attention and to express understanding or conversational problems.' Is it fair to say that because we as humans do this naturally,

almost from birth, that we tend to overlook both the values and structures of nonverbal, facial communications?

van Breemen: I agree there. It *is* so natural for us to use gestures and facial expressions that we don't think about them. But we all miss them if they are not present in a conversation—you will notice it. And it's also something that we notice with the iCAT. We're trying to build a technology to create the illusion of life. The nice thing is that when we sometimes let users interact with the iCAT, we see during the first five to 10 minutes how people really have the feeling that they're talking to a personality. But after this period, they start noticing some strange things. For instance, sometimes iCAT repeats an animation several times. Then, you feel as a user that something is wrong. If we do not turn on computer vision, and iCAT is not really "looking" at an object in the room, you will clearly notice that because if you point or focus your attention on an object in space, your conversational partner will probably look at that point, as well. If you're doing that with a robot, and the robot is not looking in the same direction, then it feels odd since you do not expect that behavior. So it's true that if you have two natural systems—or let's say, two humans who are interacting with one another—then you will not think about the nonverbal cues. But if they are missing or something is wrong there, you will notice it directly.

CPU: You mentioned that iCAT has a camera hidden in its nose, which is not a bad trick if you can manage it. It has a sense of touch and can also hear. We've discussed the touch pads and know where the camera is, but how can it hear?

van Breemen: We wanted to build a research platform for universities that just used standard components, so iCAT employs a normal Webcam and a USB sound card. If you opened the robot up, then what you would find is a USB hub connected to these. iCAT's base contains its sound card, along with some other electronics controlling the motors and reading the proximity sensor values.



CPU: There's really no limitation to the possibilities of sensor equipment in iCAT is there?

van Breemen: It's up to your imagination what kind of sensors you want to use and hook up internally into the USB hub. iCAT is currently connected by using one USB cable to a PC because all software that controls the robot runs on a standard PC. We made this decision because we saw that a lot of universities want to experiment with robotics. They buy a robot and end up building a net of systems—a very difficult thing to do. Therefore, we decided to allow users to develop their software on a PC that considers the iCAT a normal USB peripheral. This makes building applications for the iCAT a lot easier.

CPU: Have you had many applications built thus far for iCAT?

van Breemen: We constantly change themes and try to explore new application areas. For instance, we created an application where iCAT could play tic tac toe with children. In another application iCAT gave support to users who needed to program a new VCR. Our current application theme is the elderly. We see that in 20 years, we will have a problem caused by having so many elderly people and a dwindling number working in the health care field. One solution for some of this is to apply robotics technology. So we are developing an application that will allow iCAT to act as a gaming companion to the elderly. The idea behind this is that on the one hand you can stimulate their cognitive functions, their mental activities, while on the other hand it fulfills a social need.

CPU: You've mentioned universities several times in our conversation.

van Breemen: Yes. One year ago we wanted to contact more researchers in this field, so we made the iCAT platform available to universities. We built 50, and currently we have over 30 universities around the world that are using it. You really see an international community that is trying to build an intelligent iCAT, and that's good because I think that creating an intelligent robot is not something that can be done by one company. It's a team effort, and you need lots of cooperation between companies and universities. We have on the Internet a community forum with a lot of discussion between researchers on behavioral improvements.

Infinite Loop

Plugging Parking Meters With A Cell Phone

Motorists in Vancouver, Canada, no longer have to worry about constantly feeding coins into a public parking meter to avoid a fine. They can now plug a parking meter using a cell phone. By setting up an account via a city Web site (www.vancouver.ca/paybyphone), a user can call a city phone number and purchase parking meter time. The service is also set up to send text messages warning of expiring time on the meter. You can even buy more minutes and top off meters without having to go outside. If there's unused time remaining on a meter, a motorist can dial the number again to subtract the excess time. The service offers email receipts, or you can print records from your online account. Now that's what we call a parking angel!

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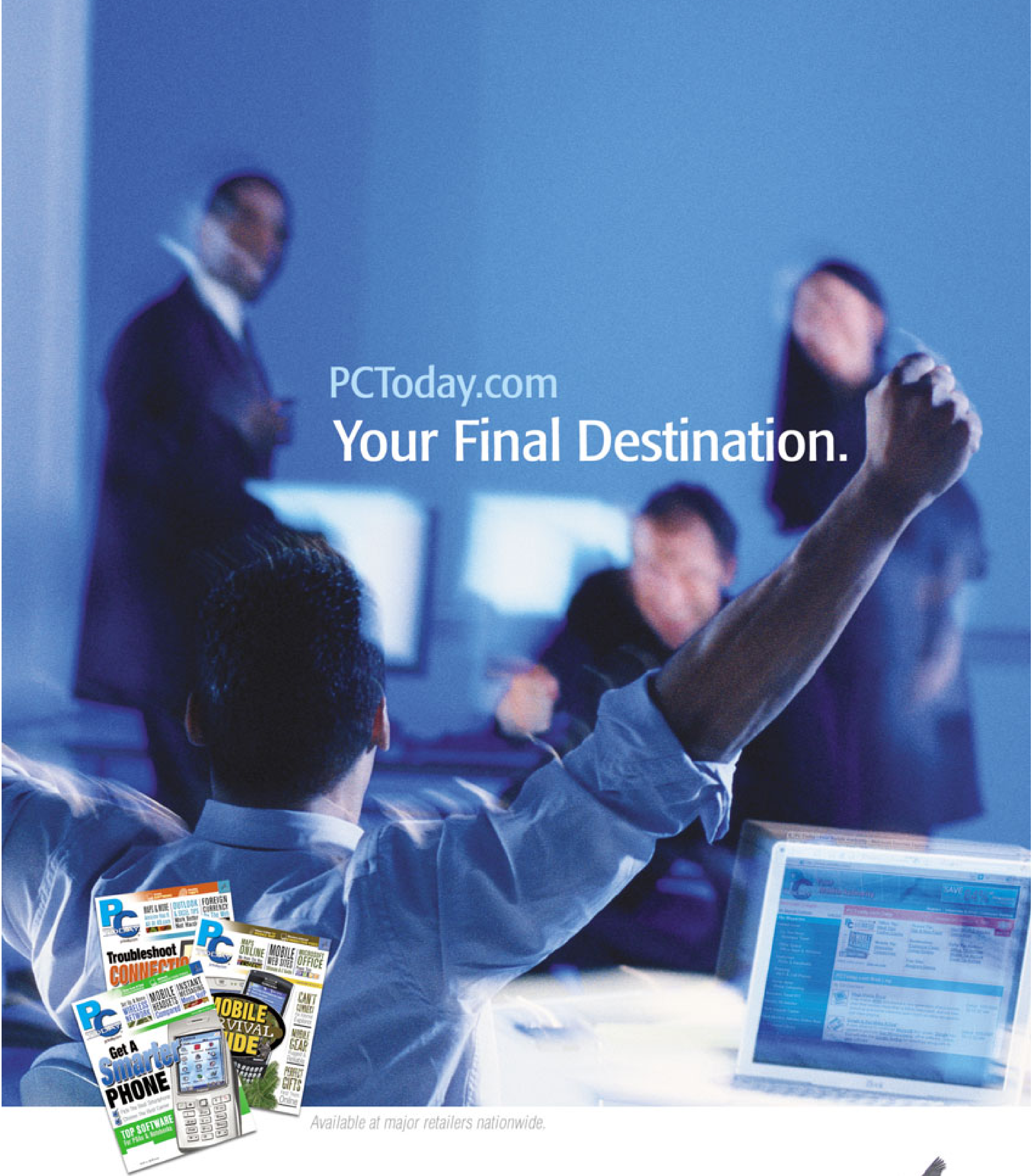

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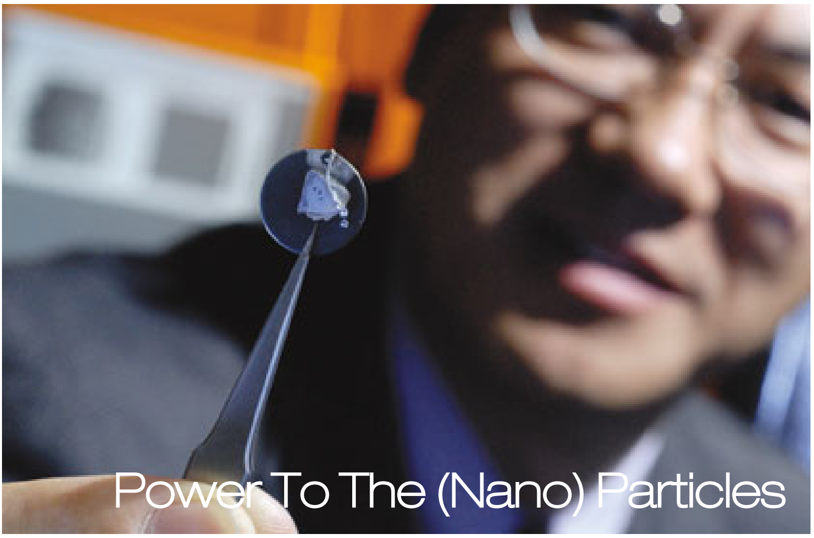
A Peek At What's Brewing In The Laboratory



Power To The (Nano) Particles

Photo courtesy of Gary Meek, Georgia Tech

It seems not a day goes by in the tech world without a headline appearing about new nanoscale devices that promise to revolutionize medicine or extend Moore's Law. But when it comes to the development of energy sources to power these tiny devices, the advances have been fewer and farther between. Current power sources such as conventional batteries are too large and their contents too toxic to use in nanoscale systems, especially those designed for use in the body.

Researchers at the Georgia Institute of Technology, however, have developed a technique to convert mechanical, hydraulic, or vibrational energy to electrical energy, creating the potential for future self-powered nanoscale energy sources known as nanogenerators. These devices would harvest the mechanical energy that is readily available in the environment to produce a steady supply of current, capable of providing power to wireless sensors, portable electronics, and implantable biomedical devices.

Professor Zhong Lin Wang and graduate student Jinhui Song created the prototype nanogenerators by growing arrays of zinc oxide nanowires, which are both piezoelectric (meaning they generate an electric charge when mechanically deformed) and semiconducting. The duo then used an atomic-force microscope tip to bend the wires individually. As the nanowires stretched and released, they generated a small amount of measurable electric current.

With further development the nanogenerators could be placed anywhere that there's enough motion to produce vibrations in the nanowires, such as in shoes, flowing water or wind, a moving body, and even in an acoustic or ultrasonic energy field. Technology is already available in the form of tiny capacitors to store the energy, so constant motion isn't necessary to sustain electrical flow.

Now that the team has demonstrated that the system can generate electrical charge, the next step is to up the voltage. Wang says, "The biggest technological challenge we will face is the simultaneous generation of electricity from many nanowires and output them in series so that we can have a higher voltage output."

Wang expects we could start seeing nanogenerators powering nanosensors in three to five years. ▲

Thought-Controlled Robots—Not Just Wishful Thinking

Imagine turning on the lights in your house just by thinking about flipping the switch. Or imagine having a prosthetic arm that performs tasks as effortlessly as a natural one. Once merely the stuff of science fiction, thought-controlled computers are a step closer to reality with a system that Japanese scientists at the ATR Computational Neuroscience Laboratories in Kyoto and Honda Research Institute in Saitama have developed.

Using brain activity that a fMRI (functional magnetic resonance imaging) scanner recorded in real-time, a team that Yukiyasu Kamitani is leading has created a robotic hand that can mimic the motions of a human hand using data from a subject making "rock, paper, scissor" movements. Other computer-brain interface projects have achieved similar results using electrodes implanted directly into the brain or attached to a subject's skull, but the fMRI is less invasive and produces a much higher-resolution snapshot of a subject's brain activity.

The system relies on the fact that different thoughts and actions create unique fluctuations in the blood flow to different brain regions. The fMRI scanner captures these while the subject is forming the hand movements and feeds them to an attached computer. Once the computer is trained to recognize which patterns are associated with a shape, the robotic hand can duplicate those shapes when the subject moves and a pattern match is made. There was a seven second lag between the subject and robot's movements, but researchers achieved an 85% decoding accuracy.

Research could eventually lead developing prosthetic robotic devices that a wearer's thoughts completely control or to computers recognizing and executing nonverbal, nontactile commands. Much work is left, however, to execute commands based on thought alone.

"A next step will be to decode the intention of an action before the action is initiated," says Kamitani. "Entertainment products like video games might implement the basic idea in as early as five years," he says. ▲

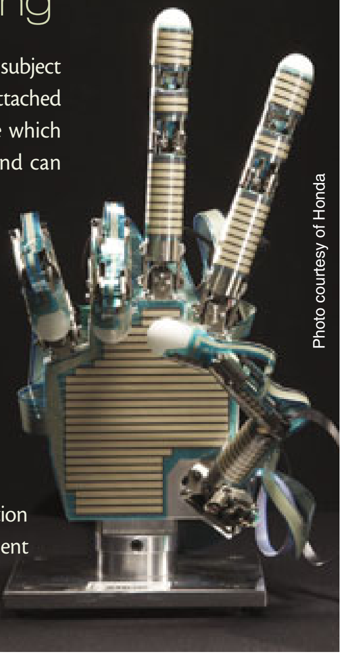
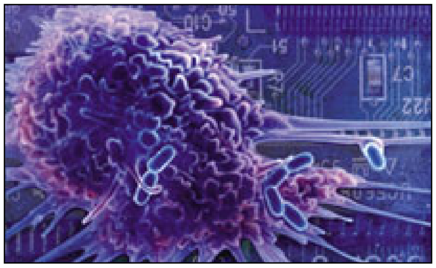


Photo courtesy of Honda

A New Take On Network Security


Graphic courtesy of Julie Greensmith

Computer security experts trying to design systems to protect networks from malicious computer viruses and hacker attacks have long used as a model the method that the human immune system handles attacks by viruses and other harmful biological agents. But just as vaccines only work against disease-causing agents that the body has been already made aware of, traditional computer security measures fall short against structurally new types of attacks, leaving the electronic patient also vulnerable.

This is because the model that has dominated both immunology and computer security is one that uses signature matching to detect intruders. A United Kingdom team of researchers that Uwe Aickelin at the University of Nottingham is leading, however, is looking to an alternative theory as a basis for an artificial immune system for computer networks that could be more effective at combating new viruses and DoS attacks.

Called the "danger theory," it proposes that a simple "non-self" reaction doesn't trigger an immune system response when a threat enters the body, but instead the immune system is reacting to danger signals that an attack (cell distress, damage, and death) causes. Aickelin has transferred this concept to the security software he's developing, which monitors a network and sounds an alarm only when it detects unusual activity, such as sudden network traffic spikes or an increase in the number of error messages.

Aieckelin says, "Our system relies on 'signals' which are polled regularly. Hence, any type of new attack can be spotted, as long as it stresses the computer."

Aickelin says the biggest challenge his research faces is getting others to understand it because the work is so different than what has been done previously. "The immunologists themselves are still having problems convincing traditional colleagues that the new theories about danger are useful and able to explain previously inexplicable aspects of immunology.

"We face the same challenge in computer science, as people are quite familiar with traditional pattern-matching computer-security approaches and because they are anchored in their beliefs find it difficult to grasp what we are doing," Aickelin says.

Aickelin is working closely with HP labs in Bristol, UK, to commercialize a system based on his research. He estimates it could be available in a five-year timeframe. ▲

MIT Takes New Material For A Spin

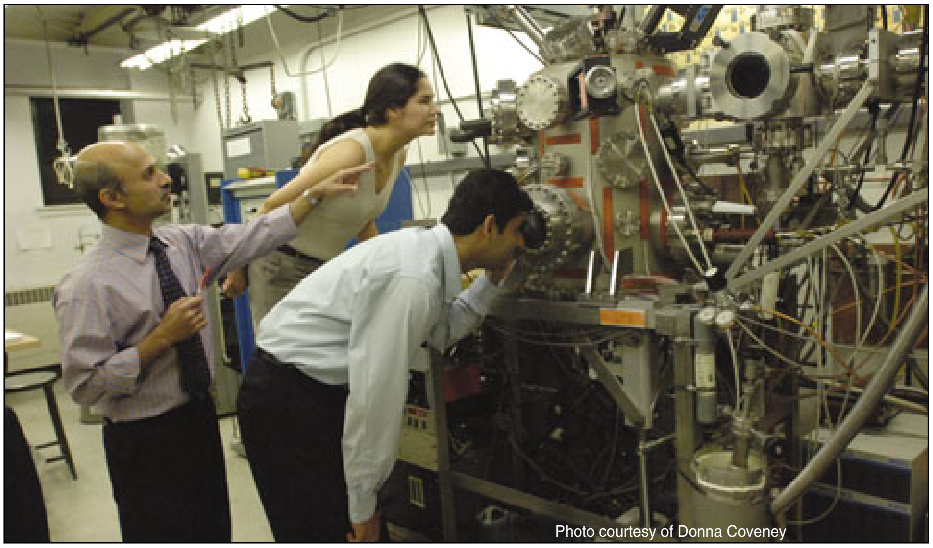


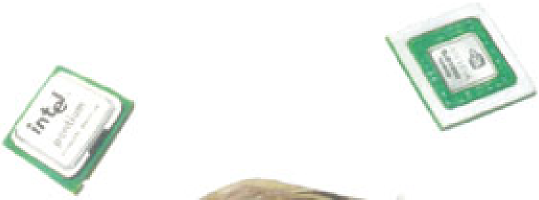
Photo courtesy of Donna Coveney

While not quite poetic enough to be the stuff of dreams, MIT's newest breakthrough *could* be the stuff that future spin-based computer chips are made of. A research team that Jagadeesh Moodera leads at MIT's Francis Bitter Magnet Lab developed the new material, a magnetic semiconductor that is made of indium oxide with a dash of chromium. Operating at room temperature and sitting on top of a conventional silicon semiconductor, the transparent material injects electrons of a certain spin state into the circuit. The electrons travel through, and a spin detector reads them on the other side.

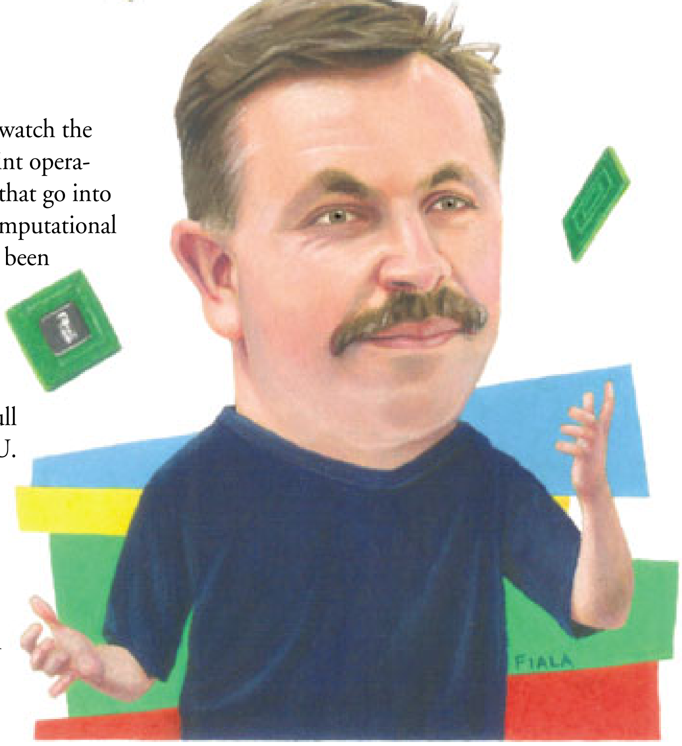
In the field of spin-based electronics, or spintronics, not only does the on/off state used in conventional electronic circuits carry information, but the spin direction (or up and down) of electronics does as well. This allows for more data to be stored in less space, and also, due to the nonvolatile nature of spin states, reduces the power consumption.

Spintronic devices are currently being used for high-density mass data storage, but many scientists see spintronics as a possible savior of Moore's Law. The material that the MIT researchers developed introduces the possibility of using spin states to carry information through an electronic circuit, applying the benefits of spintronics to computer transistors. This could result in smaller chips that not only process more data and consume less energy but that can also take advantage of reversible spin states to create multifunctional electronic devices using the same circuitry.

"We can carry information in two ways at once, and this will allow us to further reduce the size of electronic circuits," Moodera stated in an MIT press release. ▲



Q&A With Jerry Bautista



What should we make of the growing rivalry between the CPU and the GPU? Intel has a number of computer researchers who are graphics experts in their own right, and they're doing some interesting work in this space. They're hoping that the coming showdown will put Intel back on track to handle most of the processing tasks in a PC.

Intel envisions vastly more powerful "tera-scale" computers, and it has more than 80 research projects aimed at figuring out how users will use such computing in their everyday lives. For instance, a user could use a tera-scale computer to sift through terabytes of data on his laptop, letting him create studio-quality photos and animations in real time.

Jerry Bautista, director of Intel's MRL (Microprocessor Research Lab), heads a group that has to figure out the workloads of the future for computers. He believes that microprocessors are ready to take over the chores of multiple chips, including the 3D graphics chips that have been a staple part of the PC since the mid-1990s. With dozens of research projects on display as a backdrop, Bautista recently described his beliefs on the future of the CPU and graphics chips. His team believes ray tracing, a rendering technique used in the 1980s for graphics, is poised to make a comeback.

Q **What do you do?**

JB I run the Microprocessor Research Lab at Intel under our CTO Justin Rattner. It's one of four labs in our corporate technology group. The others oversee wireless, systems technology, and platforms. There are hundreds of different projects under way.

Q **Do you believe that graphics will move back to the CPU?**

JB We see a trend. We watch the FLOPS (floating point operations), the watts, and dollars that go into the graphics cards and the computational physics on GPUs. They have been a growing part of the PC budget. We are aware of that. Some graphics computation is handled well on a graphics processor; we can pull the graphics back on the CPU.

Q **How so?**

JB In the future, the load of rendering an image falls in favor of the computer side, the microprocessor, and the pixelization task becomes minor.

Q **But couldn't the graphics chip vendors just put a smaller CPU in the corner of their chip?**

JB That's something that we watch for and anticipate. It's something to consider. We have this tremendous legacy of x86 code and our compatibility with it.

Q **How soon will ray tracing on a CPU overtake graphics on a GPU?**

JB Our horizon is three to five years. We are at about a three-year point in terms of showing that these things can be done.

Q **What else do you use this computational ability for?**

JB Video searching with context. You can find a loved one in a lot of pictures at various lighting levels. These are sophisticated searches; like finding a face in an Interpol database. A vision system could recognize someone and discern their state of mind and that may make a difference in seconds before a crime. There is no end to the things we can do.

Q **What would you say to the graphics chipmakers?**

JB Instead of saying that we will win over them, I'd talk with them about the applications themselves. In today's systems, they are largely concerned with rendering. About 90% of resources are spent drawing pictures. There is not much left for physics and artificial intelligence. What happens if we have real physics and real AI kicks in?

Q **How far will ray tracing go?**

JB In ray tracing if we had 10 or 100 cores, we would see a 10X speedup. With 1,000 cores, we would see 100X speedup. It just keeps going. Ray tracing can swallow up whatever compute we build. At what point do you get diminishing returns? ▲

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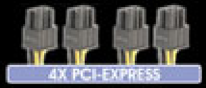

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